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B O T A N Y;

C O N T A I N I N G

Accurate, compleat and easy Descriptions of all the known

G E N E R A O F P L A N T S:

Translated from the Latin of the celebrated

C H A R L E S V O N L I N N É,

Professour of Medicine and Botany in the University of Upsal; First  
Physician to the King of Sweden, Knight of the Polar Star, and Mem-  
ber of most of the Learned Societies in Europe.

To which are prefixed,

- I. A View of the ancient and present State of Botany.
- II. A Synopsis, exhibiting the essential or striking Characters which serve to  
discriminate Genera of the same Class and Order; as likewise the secondary  
Characters of each Genus, or those derived from the Port, Habit or general  
Appearance of the Plants which compose it.

By C. O L I N M I L N E,

Reader on Botany in London, Author of the BOTANICAL DICTIONARY.

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L O N D O N :

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## ADVERTISEMENT.

A Translation of the *GENERA PLANTARUM* has not hitherto been attempted in any language, notwithstanding the great reputation of its ingenious author, the distinguished taste of the present age for improving and diffusing natural knowledge, the excellence of the work itself; and, above all, its indispensable use to every botanical student. The characters of classes and orders, the primary divisions in every method, are generally constituted from a single circumstance; so that genera, without the assistance of accurate and compleat descriptions, may be easily referred to their proper place in the arrangement. But in detecting the genera of plants, or referring any particular plant to its genus or assemblage, such a complication of circumstances must necessarily pass under review, arising from a comparison of all the parts and modifications of the flower and fruit of the plant in question, with those of the genera of the same class and order, that it is impossible, without the aid of descriptions, and those full and accurate,

to



to advance a single step with certainty and precision. To the learned and classical reader, the *GENERA PLANTARUM*, in its original form, serves every purpose of information for which it was intended; but to the illiterate and unclassical, who, by the way, constitute the bulk of those whom inclination or chance have directed to the study of plants, that form proves an insurmountable obstacle. It deserves likewise to be mentioned, that many Ladies who would apply with indefatigable attention to the science of plants, are denied the pleasure resulting from such a study, for want of proper assistance in a language which they understand.

For these reasons, it appeared highly probable that an English translation of the *GENERA* would prove not altogether unacceptable to the public. To render it, in some measure, more compleat, the Translator has presented the reader with a Prefatory *View of the ancient and present State of Botany*, including a particular analysis and illustration of every plan of arrangement which has appeared since the origin of the science. The utility of such a discussion is too obvious to be insisted on. In characterising the several authors which pass under review, the Translator is not conscious of having indulged malevolence, or discovered want of candour. The merits and defects of each method  
are,

are, to the best of his judgment, impartially stated; their comparative excellence it is the province of the intelligent botanist to estimate and determine. He hopes it will not be imputed to him as a fault, that, in a few controverted points, he has ventured to differ in opinion from some of the most distinguished names in Botany. Such dissent has been always accompanied with reasons which, to him, appeared satisfactory: if they appear otherwise to the reader, he is at freedom to think for himself, and reject the opinions, so lamely defended, as heretical and erroneous. Throughout the work, he has endeavoured to express himself with perspicuity and precision; and, in enumerating the characters of the genera, has carefully avoided that affected conciseness which has lately crept into botanical description, and is totally repugnant to the genius of our language.

UPON the whole, the Translator flatters himself that his hopes of success are by no means equivocal. The attempt surely needs no apology: the execution must speak for itself. The Translator has devoted his whole time and attention to the study of plants. In that department he desires to be useful to the Public: and if, in the course of his repeated endeavours, he shall be happy enough to remove that air of mystery, and dispel those clouds of obscurity in which he found  
his



his favourite science involved, he doubts not that the Public, enemies to the monopolizers of knowledge, and ever disposed to encourage laudable pursuits, will candidly acknowledge that he has obtained his wish.

The Translator cannot conclude without offering his grateful acknowledgments to all the friends and well-wishers of this work, and particularly to John Hyde, Esq; Governor of the London Assurance, and Fellow of the Royal Society; by whose generous assistance he has been enabled to carry it on. With pleasure could he expatiate on that universal benevolence, that unbounded desire of doing good, which characterise every action of this best of men, the value of whose favours is so greatly enhanced by the exalted motives from which they proceed, and the truly engaging manner in which they are conferred. But he knows the extreme delicacy of the subject, and shall therefore forbear: happy if he has not incurred his displeasure by giving this small, though heart-felt, testimony of his goodness.

A VIEW



A  
V I E W  
O F T H E  
A N C I E N T A N D P R E S E N T S T A T E  
O F  
B O T A N Y.

Including a particular Illustration of every Plan of Arrangement  
which has appeared since the Origin of the Science.

*Filum Ariadneum Botanices est SYSTEMA, sine quo Chaos est Res Herbaria.*

Lin. Phil. Botan. P. 98.

*Quid unquam Botanica, vel quis Botanicus absque Methodo?*

Lin. Claves Plant. in Præfatione.



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S E C T I O N I.

*Characteristical Distinctions of the Three Kingdoms of Nature.*

A L L natural bodies considered *in cumulo* agree invariably in certain qualities, hence stiled the Universal Qualities of Matter. These are Extension, Figure, Mobility, Divisibility and *Vis inertiae*. Every body is extended, has figure, may be moved, is divisible into parts, and is sluggish or inactive. The universal properties of matter, just mentioned, are the objects of Natural Philosophy: but being possessed indiscriminately by all bodies, become neglected in Descriptive or Natural History, where the subjects are arranged, not from circumstances of universal similitude, but the contrary.

THE quiescent forms of bodies, and their co-existing qualities, about which Descriptive History is conversant, sufficiently distinguish it from Narrative History, whose object is active nature, the operations of which are exceedingly diversified.

MAN, with respect to the anatomy of his body, is, in some measure, a subject of description. Such variety, however, does he exhibit in point of character, talents, capacity, ingenuity and force, that each individual of the same age is sufficiently distinguished from every other; nay, whole races and ages of men are diversified in like manner: so that human affairs are much more properly the subject of Narrative than Descriptive History. Those only are, with propriety, to be stiled subjects of the latter, where the description of a single individual exhausts the description of the species to which such individual belongs. As individuals constitute a species, so a number of different species agreeing invariably in certain circumstances, constitutes a genus or kind; and genera, having resemblances of the like nature, form higher divisions or classes. Thus the principal object in Descriptive History is to form these divisions of the subjects to be described; and, for that purpose, to enquire minutely into their nature, their different parts, and their resemblances; as it is upon the circumstances of similitude and contrast that the Method or Arrangement in Descriptive History depends. This method of combining different subjects under a point of resemblance, is an act which the mind is continually exerting in the acquisition of knowledge. No fact or particular is left solitary or detached. The mind naturally looks for its help-mate; and, by regarding many different subjects under one point of view, facilitates its progress in each attainment. We are always led to generalize. We do so in Descriptive History; we comprize several species under one genus, and several genera under one class or order, where  
the



the resemblance in each particular species or genus is invariable and strongly marked. Thus for the purpose of acquiring knowledge easily, we generalize, we arrange, we seek grounds of resemblance. In Narrative History, where nature is considered as active, we generalize her operations; and what in the combination of mere quiescent forms, was only matter of arrangement, becomes here a foundation of science, a law, a principle. It is in this way, that the flight of projectiles, the motions of the planets, the flux and reflux of the sea, and a variety of other operations and appearances in nature are adequately explained by Sir Isaac Newton on the principle of gravitation, and the first law of motion. From Narrative History then we attain principles of science, by generalizing, or viewing combinations of effects in their points of resemblance. By generalizing in Descriptive History, we obtain combinations from similitude, which constitute the knowledge of mere arrangement.

THE operations of nature being but different combinations of her quiescent forms in an active state, it is absolutely necessary that our knowledge of the quiescent forms should precede that of active nature. Hence Natural History should precede Natural Philosophy, where operations are generalized, and principles of science thence obtained.

THE first and most obvious division of natural bodies that would present itself, is that into Animals, Vegetables and Minerals; or, as they are commonly designed, the Three Kingdoms of Nature. In making this division, we lose sight of the points in which these three different classes of bodies concur, and only pay attention to the circumstances in which they differ. It requires, however, a perfect knowledge of all the natural bodies on this globe, and their most intimate qualities, to form charac-

teristic differences which shall include every individual of one division, and exclude the individuals of every other. As such a knowledge has never yet been attained, we have not been able to fix precise boundaries to any of these kingdoms. The marches are still obscure and undecided: and such uncertainty indeed has prevailed on this subject, that some learned Naturalists have disputed the division, being inclined to believe that all natural bodies are comprized in a kind of scale or chain, whose gradations are beautifully marked by the great variety in all the parts of Nature's productions. Man, as possessed of thought and intelligence, is placed at the top of this scale. The inconceivable variety among men arising from genius, character, capacity and force, gives rise to as many degrees upon the scale of intelligence. As we descend, Reason seems to lose itself, and be confounded with the finer instincts of the higher kinds of animals; as the monkey, elephant and horse. Thus it is, they suppose, that the several beings in the world possess a place in this scale; and that such is the number of gradations, and so insensible their progression, that the lower link in a particular class of beings is, by imperceptible shades, connected with the higher link of a class of beings inferior in their nature to that immediately above it. It is in this manner that they would connect the most seemingly imperfect animals, as the Polypes, with the Sensitive Plant, which for that reason they consider as joining the Vegetable and Animal Kingdoms. The Vegetable, which possesses the middle place, is likewise supposed to be connected with the Mineral Kingdom on the other hand. The dusty Byssus, a species of Flax, scarce enjoys an apparent distinction from the earth on which it grows.

INGENIOUS however as this Scale of Beings undoubtedly is, and great as is its utility both in theory and practice, it seems most probable, that the three Kingdoms of Nature are perfectly  
distinct



distinct from one another, though men have not hitherto been extremely successful in establishing the characters of each division. The truth is, that the amazing variety which obtains among natural bodies, so characteristic of Omnipotence, proves highly unfavourable to either position, and must render imperfect any method of division which can possibly be devised. For if we ascend from the irregular coalescence of the mass of earth in the mineral kingdom up to man, as the most perfect animal, several bodies are found in the vast intermediate space, which cannot be reduced but with the utmost difficulty into any certain and definite series.

DIVERSITY of form in the same species is assigned by Ludwig, as the distinctive character of minerals; whilst locomotive powers, according to that author, sufficiently distinguish the animal from the vegetable. “When we attend,” says Ludwig, “to the difference of natural bodies, we observe in some, “ constantly the same form, arising from the figure, situation, connection and proportion of the parts: in others, “ we observe no such invariable form, but are led to determine their nature, from the mixture or aggregation of “ the parts. The former are called Vegetables and Animals, and proceed from seed, and from an egg; the latter “ Minerals, and arise from the coalition of particles meeting together from a variety of causes.

“THE seed being the vegetable egg, the difference now introduced serves not to discriminate vegetables from animals. “ Betwixt these, however, a manifest difference obtains. For, “ whilst vegetables are devoid of loco-motive powers; that is, “ cannot transport themselves, by proper organs, from place to “ place; the animal can perform his appointed motions by the “ parts

“ parts proper to his frame; so that even if he is at rest, we may  
 “ observe a disposition or aptitude in his several limbs to un-  
 “ dertake their respective motions.

“ NATURAL bodies, then, which have always the same  
 “ form or appearance in the same species, and are endued with  
 “ the power of motion, are called Animals, and are subdivided,  
 “ principally from the organs of progression, into quadrupeds,  
 “ birds, fishes, amphibious animals, worms and insects. The  
 “ doctrine of animals is termed Zoology.

“ NATURAL bodies which have always the same form in the  
 “ same species, and are devoid of loco-motive powers, are called  
 “ Vegetables or Plants. The doctrine of vegetables is termed  
 “ Phytology or Botany.

“ NATURAL bodies which have a different appearance in the  
 “ same species, and although they frequently agree in the inter-  
 “ nal mass, differ in external structure, are called Minerals. The  
 “ doctrine of minerals is termed Mineralogy. This kingdom  
 “ of nature is frequently stiled the fossil kingdom, because several  
 “ bodies pertaining to it are dug out of the bowels of the earth.  
 “ Others, as Linnæus, call it *regnum lapideum*, because the great-  
 “ est part of bodies belonging to it have earth for their basis.  
 “ The term Mineral, is, perhaps, to be preferred, as seeming  
 “ to indicate a body formed by the coalition of earthy particles  
 “ variously mixed together.

“ WE allow,” says Ludwig, after enlarging upon this distin-  
 “ ction, “ that the differences just proposed, are often not suffi-  
 “ ciently circumscribed in their limits. The *urticæ marinæ*,  
 “ and other zoophytes, seem to open a communication betwixt  
 “ animals



“ animals and vegetables ; as do the mosses, lichens, lithophyta  
“ and chrystals betwixt the latter kingdom and that of mine-  
“ rals. Yet as the principal classes of natural bodies” (continues  
he) “ may thence be certainly enough defined, we rest in this  
“ division, being persuaded that doubts of a similar nature will  
“ arise upon the foundation of any mode of arrangement what-  
“ ever.”

FAVOURABLY, however, as Lüdwig is inclined to think of  
this distribution, it is far from being either exact or satisfactory.  
Chrystals and petrifications have always a regular figure in the  
same species. There are plants which are not fixed to one place,  
and animals which are, as Corallines, and some of the testaceous  
tribe. Linnæus's distinction, after Jungius, is much more ac-  
curate. “ Lapides crescunt ; vegetabilia crescunt & vivunt ;  
“ animalia crescunt, vivunt & sentiunt.” That is, as it is well  
illustrated by a modern author, minerals have increase without  
life, organized parts, regular growth or sensation. Vegetables  
have a regular growth and a degree of life, but no sensation.  
Animals grow, live and feel. Minerals have no vessels. Vege-  
tables have vessels for their nutritive juices. Animals have nutri-  
tive vessels and nerves, a peculiar and distinct system and the cause  
of sensation. Here then we have found an essential, universal  
and invariable difference of the three great classes or kingdoms  
of nature. Minerals wanting vessels, though they may be en-  
creased by an addition of parts, cannot have a regular growth ;  
for that must depend on organized vessels. Plants having vessels,  
may have a regular growth ; for it is the effect of their proper  
office : but wanting nerves, they cannot feel ; that being the  
quality of nerve alone. Animals, which have nutritive vessels  
and nerves, grow and feel ; these being the offices of those two  
systems.

THIS



THIS fixed character being established, the sensitive plant and some other well-known instances still recur. All that can be said with respect to such instances is, that they are exceptions to the general law of their being; for nature makes all her changes by minute gradations, and leaves no great gap in the universal chain. In fine, a distinctive character being established, there can be little difficulty or confusion.

VEGETABLES then are placed in a middle state, between the sentient animal and the unorganized mineral; inferior to the former, superior to the latter. Animals and vegetables agree in many particulars. They grow, and are nourished. They are furnished each with an organized structure, that is, consist of parts which co-operate in producing the changes that are effected in their frame. The nourishment, which they receive in a very different manner; the vegetable from the soil in which it is placed; the animal searching about in quest of it; is filtrated through the vessels, and by a process which we cannot explain, assimilated to the substance of the plant or animal, so as to repair its waste, and increase its growth. Thus an analogy manifestly obtains betwixt vegetation and the animal œconomy. The root attracting moisture from the soil, and absorbing it, may aptly enough be compared to the stomach and lacteals of animals; the course of the sap to the circulation of the blood; the absorption of the redundant moisture by the sun, to animal perspiration. Accordingly such terms have been invented, and we speak of the circulation of the sap, the perspiration and respiration of plants. Strong, however, as this analogy is, we cannot explain any of the facts in the one subject by those of the other. Their laws and *modus operandi* are quite distinct. No fact in vegetation can explain animal heat. In fine, mechanics, vegetation, animal œconomy, and intelligence, are subjects that are quite distinct, totally independent, and can never explain each other.

SECTION

## S E C T I O N II.

*The extent of Botany, its advantages, and the obstacles that have retarded its progress.*

THE preceding section established the geography of my subject, by fixing its limits, and ascertaining its precise place in the extensive department of natural knowledge. I propose, in this section, as a proper introduction to this part of the work, to lead the reader into an enquiry respecting the advantages which attend the study of Botany, the extent of that science, and the difficulties which have proved obstructive of its progress.

NATURAL history, in its several branches, is an entertaining as well as useful study. To the former of these characters, none, I am confident, will dispute its claim. Those even who have been most lavish in invectives, allow it to possess this merit : if that can, with propriety, be said to possess any merit whatever, which has not utility to recommend it. And, indeed, what study can be more entertaining ; nay, I will go farther, what can be a more rational and manly study than that by which we attain an acquaintance with the works of nature ! The curious instincts of animals, the beautiful variety in the vegetable tribes, the hidden wonders of the fossile kingdom, are objects which awake attention, and prove an inexhaustible fund of pleasure and delight.



INDEPENDENTLY of its utility, the study of natural history is with peculiar propriety recommended to such as enjoy still life, or who intend to visit foreign countries.

NOTHING can be more suited to the innocence and gay simplicity of the country than the study of Botany. No situation can be more favourable for such a study. The country is Nature's perpetual residence; it is there she puts on her richest attire; it is there she appears in her most engaging charms: and void is he of sensibility indeed, who can view with unconcern such artless beauties!

To acquire a knowledge of the natural productions of their own country is now pretty generally an object with gentlemen who enjoy the advantages of a liberal education. To travel with profit, we must extend our views. From difference of soil, climate, and a variety of concurring causes, nature, in different countries, assumes very different appearances. Let us familiarize ourselves to these appearances, and, not contented with a bare knowledge of nature as she exhibits herself to us at home, let us view her in the various modes and dresses which she is pleased to assume.

A TRAVELLER very naturally enquires into the geography of the countries which he purposes to visit, their boundaries, extent and situation, their cities, mountains and rivers; the manners and customs of the people, their policy and government. The man, curious in nature, will go a step farther; he will make himself acquainted with the internal geography, if I may be allowed that expression, of the different countries through which he is to pass. His knowledge will not be confined to the situation and extent of rivers, forests and mountains; he will likewise know  
what

what he is to expect in those rivers, in those forests, and on those mountains.

I SAID, that natural history is an useful study. Can we for a moment doubt it, when we recollect that it furnishes one of the strongest arguments for the existence of a supreme intelligent Being? To produce a stronger proof of its utility is impossible: to enforce the study from other motives is unnecessary. The works of God are the most easy and intelligible demonstrations of his being and attributes; and he who carefully studies those works may be truly said, in the beautiful language of the poet, "To look through nature up to nature's God."

BUT to be convinced of the utility of Botany, let us consider its extent. And here it is to be observed, that, in our researches into natural bodies, we either pay attention to the external surface only, and the corporeal properties obvious to the senses, particularly to that of sight, and thence institute the distribution into genera and species; or we search into the internal fabric, by dissecting or resolving the parts which are constituent of the bodies, and thence deduce their origin and changes. The knowledge resulting in the first case is called the historical knowledge of nature, or natural history, properly so called; in the latter case, the scientific or physical knowledge of nature. What obtains with respect to natural history in general, holds also in considering the parts of which it is composed. Thus, Botany, a part of natural history, is either historical or physical. Physical Botany, or the philosophy of plants, treats of the constituent parts of vegetables, their internal fabric or structure, their fluids and solids, and the motion of the former through the latter. Hence the circulation of the sap, the perspiration and respiration of plants by the leaves, and a variety of curious phæ-



nomena in the vegetable œconomy connected with gardening, arrange themselves under the extensive head of Physical Botany.

IMPORTANT as the philosophy of plants certainly is, it cannot be denied, that the various distributions into species and genera from circumstances of resemblance in the external forms and appearances of plants, and the numerous systems or combinations thence arising, are the proper objects of Botany. Historical Botany then is Botany properly so called; and to have an accurate and extensive distinctive knowledge of plants, as connected by similitude, or separated by contrast, is to be an expert botanist. “Botanicus,” says Linnæus in the Preface to his *Genera Plantarum*, “est ille, qui vegetabilia similia similibus, & “distincta distinctis nominibus, cuicunque intelligibilibus, noscit “nominare.” The same idea predominates in Boerhaave’s definition of Botany, which, according to that learned author, is “a part of natural knowledge, by means of which, plants are “most certainly and easily known, and engraved on the me- “mory.”

BUT whither does all this tend? For as yet we have seen no useful purpose that such a distinctive knowledge, however extensive, is calculated to promote. Is it then to be acquired merely for its own sake? Or would the pleasure derived from such an useless acquisition make amends for the labour and time which had been so improperly and fruitlessly bestowed? Let us pay attention to these queries; they will, perhaps, lead us to obviate one of the strongest objections that can be made to the science of Botany.

I BEGIN with observing, that a distinctive knowledge of the several orders of plants, such as can be acquired by inspection alone, the most intimate acquaintance with the various resem-  
blances



blances and contrasts upon which those orders are founded, are of little importance considered by themselves. A man possessed of such knowledge, without applying it to any useful purpose, has, indeed, spent a great deal of time ingeniously upon trifles, which might have been more honourably devoted to the good of society, and the exertion of genius. Uninteresting, however, and even detrimental as acquisitions of this kind may prove, when attained merely for their own sake, their tendency to promote the purposes of useful science is indisputable; and where that tendency is seconded by proper industry and application, the acquisitions themselves must rise proportionally in our esteem. With propriety, therefore, is Botany divided into two great parts; the first, respecting the knowledge of the several parts of vegetables, and their various assemblages, as connected by resemblance, or distinguished by contrast; the second unfolding their properties, virtues and medicinal powers. The relation betwixt these parts is mutual and dependent. The latter cannot be acquired without a competent knowledge of the former; the former, though attainable without any such assistance, derives its utility from its application to the latter.

THE reality of this mutual dependance betwixt the two grand objects of botanical knowledge may be inferred from the want of success which has accompanied every attempt to disunite parts so closely connected. The ancient Botanists, particularly Aristotle, seem to have paid very little attention to the resemblances on which a distinctive knowledge of plants is founded; their aim was, to possess themselves of the useful part of the science, without encountering its difficulties. The event, however, has shewn, that they were egregiously mistaken; and, that, by endeavouring to ascertain the powers of vegetables, without a previous

vious knowledge of vegetable arrangement, they, in effect, laboured to attain an end, without using the proper means to accomplish it.

SENSIBLE of the inconveniencies to which this error had subjected the several departments in natural history, the moderns have bestowed their attention principally on description and systematic arrangement; and, from an excess of refinement, too common in modern times, have hurried into an error of much worse tendency than that which they laboured to avoid. A nice and scrupulous attention to the minutiae of science is the characteristic distinction of the present age; and in no science is this minutely discriminating spirit so conspicuous, or so detrimental, as in Botany. Not that to discover resemblances, even the most trifling, is in itself hurtful to science; on the contrary, every such discovery, if properly digested, is an accession to science. But it is to be feared, that, in proportion as these minute resemblances engross the attention, we shall lose sight of the great object of our pursuit; and, involved in fancy and chimæra, stop short at the means, without having either inclination or ability to attain the end. In fine, we shall rest in a bare knowledge of vegetable productions, without applying it to those purposes which alone determine its utility.

BUT from all this it were quite unphilosophical to conclude that natural history in general, or botany in particular, is an useless study. The very best things are liable to be abused. But is such an abuse to be employed as a solid argument of their futility and uselessness? By no means. The same science which has been disgraced by a butterfly-catcher, or a hunter after cockle-shells, is immortalized by the labours of a Bacon, a Boyle, and a Linnæus.



PREJUDICES, however, of this kind, have been entertained; and, because a distinctive knowledge of plants must necessarily precede that of their virtues and medicinal powers, men wrongly imagined that classing and arranging plants according to certain minute resemblances was the sole business of the botanist. They condemned, therefore, the science as frivolous and useless, because, perhaps, some had stopt short in the road, without seeking to obtain what should have been the main object of their pursuit.

I FIND I have been insensibly led from the advantages that attend the study of Botany to its difficulties; and of these we have already encountered the most formidable. Let us take a short view of some other circumstances in the nature of the science which have been found obstructive of its progress.

WHERE the differences are striking, the knowledge of a subject is easily obtained. Plants are remarkably similar in their form and appearance, and are therefore extremely difficult of investigation.

ADD to this, that the objects about which Botany is conversant are exceedingly numerous and minute. They can therefore only be distinguished by minute examination, which few, but those of a curious turn, are disposed to afford them; and hence the progress of the science has been at all times slow and inconsiderable.

THE confusion too that has ever prevailed in botanical language, and which is not yet totally removed, has been a mighty impediment to its progress; and the great uncertainty in fixing the genera, which Linnæus, the Father of modern Botany, has at length



length accomplished, added to the other difficulties already mentioned, must have given a beginner a very unfavourable idea of the science he intended to study.

BEFORE I leave this subject, I must take the freedom to mention that I am not amongst the number of those who think that the science has been injured, or rendered more difficult by the great number of methods, or, as they are called, systems, which have been constructed for arranging vegetables. As each of these systems is founded upon the structure of a particular part of the plant, it is evident, the greater number of systems we are acquainted with, the more knowledge shall we have acquired of the different parts upon which such systems are founded. By an arrangement from the structure of a particular part, as the root, I am led to consider that part with attention, as it exhibits itself, not in a few plants, but through the whole vegetable system, when, perhaps, without such a remembrancer, I might be apt to disregard or overlook it altogether.

HAVING in this manner endeavoured to obviate the principal objections which have been made to the science of Botany, and enumerated the chief difficulties which it has encountered in its progress, arising almost solely from an ill-grounded opinion of its being little else than a simple nomenclature, or, at best, calculated merely for amusement: I should now proceed to direct the reader's attention to the main object of this prefatory VIEW, for exploring which he is now sufficiently qualified. It will not, however, be improper previously to mention the apparatus with which every beginning Botanist ought to be furnished for the more easy and accurate examination of plants; and to that purpose I shall dedicate the remaining part of this section.

THE

THE apparatus in question is as follows :

A SMALL magnifying glass for viewing the minute external parts, as those of the flower and fruit. Linnæus's genera, the characters of which are taken from very minute parts, render such a glass absolutely necessary.

A SHARP needle for dissection.

A MICROSCOPE for viewing the internal structure, and those external minutiae which elude the naked eye.

A BOTANICAL knife.

ON herborizing excursions into the country, a small tin box for containing specimens of the plants which have occurred in the progress. Dillenius was the author of this invention.

IN dissecting plants, particularly with a view of investigating their several internal parts, and separating them from one another, maceration in water is necessary.

PUTREFACTION too is of singular use in this respect.

WHERE specimens cannot be procured, the botanist should have recourse to the best engravings of the several parts, as Tournefort for the external, Grew for the external and internal parts; Blackwell's herbal, Miller's figures, and *Flora Lapponica*, for the entire plant.

IN the delineating of plants by figures, Columna, Dillenius, Aubriet and Ehret, are eminent. The two former were professed Botanists; the two latter artists, who, by long experience, became Botanists. Such figures, to be perfect, ought to exhibit



all the parts, even the most minute. Particular attention is likewise to be given to their situation and natural size.

THE best figures on wood are those of Gefner and Rudbeckius; on copper, Ferrarius, Dodart in 1676, Breynius, Comelin, Loefel, Rheede in 1678, Hermannus, Tournefort in 1694, Vaillant in 1718, Micheli in 1729, Haller in 1742, and Millar the Engraver, in his series of plates explanatory of the Linnæan system in 1770; on tin, Dillenius; out-lines without shade, Brunsfelsius in 1530, Fuchsius in 1542, Clusius in 1576, and Father Plumier in 1693, illuminated or coloured after nature, Martin in 1728, Blackwell, Catesby in 1731, Weinman, Ehret in 1748, Trew in 1750, and Millar in 1770; engraved or impressed from the leaves themselves, Hesselius's American plants in 1707; and Knipphofius, a German, in 1733.

OF Botanists who have written an Universal History of plants, the most eminent are J. Bauhin, Morison and Ray. Of partial histories, or the description of a particular class of vegetables, are Dillenius's arrangement of the mosses; Sceuchzer and C. Bauhin's description of the grasses; Plumier's American ferns; Pomet, Valentine, and Godfrey on the officinal plants.

OF such as have employed their researches upon one vegetable only, the principal are, Dillenius on the *ficoides*, or fig-marigold; Boerhaave on the *protea*; Kempfer on tea; Haller on garlic, and the mountain speedwells; Breynius on the famous ginseng of China; Bradley on the aloe; and Linnæus, in some detached pieces in the *Amœnitates Academicæ*; such as the dissertation upon the dwarf birch, the plantain tree, the fig, passion-flower, *lignum colubrinum*, and several others.

AMONG

AMONG the enumerations of the indigenous or native vegetables of any particular place or country, or, as they are called, Floras, may be ranked in the first place Linnæus's *Flora Suecica*, and *Lapponica*; Haller's *Helvetica*; Ray's and Hudson's *Anglica*; Magnolius's *Monspeliaca*; and Gmelin's *Sibirica*.

AN enumeration of the plants that are cultivated in any garden, whether public or private, is termed by Botanists, *Hortus*. The most eminent of these are Linnæus's *Hortus Cliffortianus*; Gouan's *Hortus Monspeliacus*; and in England, lately published, Hill's *Hortus Kewensis*, containing a catalogue with short generic characters of the numerous and valuable collection of plants in the botanical area of the gardens at Kew.

OF travels for the improvement of botanical knowledge, the most noted are, Sceleuchzer's journey over the Alps; that of Calceolarius and Pona to Mount Baldus; Ray's travels and voyages; Tournefort's voyage to the Levant; Adanson's voyage to Senegal; Gmelin's travels into Siberia; and lately published, under the auspices of Linnæus, the travels of Dr. Frederic Hæsselquist into the East, for the purposes of advancing natural knowledge. The reader, curious in these subjects, may likewise consult Prosper Alpinus and Shaw on the plants of Egypt; Sloane and Brown's natural history of Jamaica; Rheede's plants of Malabar; Hernandez and Feuillé on the plants of Mexico and Peru; and the valuable collection published by that ingenious traveller, Kempfer, by the title of *Amœnitates Exoticæ*.

THE best writers on the anatomy and physiology of plants, and the vegetable œconomy are, Grew, Malpighi, Duhamel, M. Bonnet, Gefner, Ludwig, and the late learned Dr. Stephen Hales, in his excellent treatise, entitled, *Vegetable Statics*.



THE powers of vegetables, and their influence upon the human body, have employed another set of writers, as Pomet, in his history of drugs, and the numerous writers on the *Materia Medica*. Geoffroy and Tournefort have considered plants in this light as chemists; Porta, Bodenstein, and Pappen as astrologers; Hasselquist and Camerarius as botanists.

ON the culture of plants, or gardening, the most approved English authors are Bradley in various pieces, and Miller in his *Gardener's Dictionary*.

FOR an explanation and application of the sexual system, the reader must consult all Linnæus's books, particularly the *Philosophia* and *Critica Botanica*; *Sponsalia*, *Genera & Species Plantarum*, and the second volume of the *Systema Naturæ*. The first-mentioned book contains the rudiments of the science, as new-modelled by Linnæus. The second is a rationale of the new botanical nomenclature; the third contains the arguments for the sex of plants, with a particular illustration of the method founded by the author upon that doctrine. The *Genera Plantarum*, to a translation of which this View of the State of Botany is prefixed, contains exact and compleat descriptions of the parts of the flower and fruit, and is an application of the terms respecting those parts delivered in the *Philosophia Botanica*. In examining flowers therefore, with regard to their minute parts, and their several modifications, the book just mentioned must be our constant companion.

THE *Systema Naturæ* contains the essential characters only of the genera, together with the specific differences, or characteristic marks of all the known species of each genus. This book then begins to be useful after a competent knowledge is obtained

obtained of the parts of the flower and fruit by the assistance of the *Genera Plantarum*, and the object is, not to apply terms, but to explore plants. It is then that by comparing the essential or striking characters in the *Systema Naturæ* with those of the plant to be discovered, we can, with great facility, ascertain the genus in question; and, by applying the terms used to denote the species, the species also.

As the species can in this manner be explored by the assistance of the *Systema Naturæ*, the use of the book entitled *Species Plantarum*, may seem, in some sort, to be superseded. The fact however is, that the last-mentioned work is not solely useful in detecting the species of plants: it contains likewise the synonymous names of the most approved authors, together with the place of growth, and duration of each particular species: and is chiefly calculated for the experienced Botanist, whose object is not to explore plants, but to obtain as much information as he can from different authors respecting the history of plants already known.

THE scientific, or technical terms of Botany, as new-modelled by Linnæus, are collected by that author in his *Philosophia Botanica*, and arranged in a particular order by Johannes Elnigren, a pupil of that celebrated Naturalist, in a paper published in the sixth volume of the *Amœnitates Academicæ*. These terms, by reason of their number, and the great confusion that obtains among them, give no small discouragement to the beginning Botanist. In a science of such minute investigation as Botany, and where the subjects to be examined are so remarkably similar, the necessity of the utmost precision is obvious. Till very lately, however, the nomenclature of this science was exceedingly defective in this respect. Linnæus has totally reformed the language



guage of Botany, and, indeed, in a great measure, introduced a new language into the science. The Linnæan terms, notwithstanding, are far from being unexceptionable. Of Greek original, they cast an air of obscurity, and even mystery, over a science which, of itself, is simple and perspicuous. Many of them too are totally unclassical; few convey the meaning readily; not to mention the great number of synonymous terms, than which there can be no greater imperfection in scientific language. The source of this error is to be traced in the bad arrangement or disposition of the terms themselves. All scientific terms are properly divided into general, and special or particular. Such a division prevents the use of synonymous terms. General terms I call such as can be applied to all the parts of plants indiscriminately, and may be arranged under certain modes, as of duration, figure, place, situation, surface, margin, summit. The particular or special terms are such as apply to a particular part only. Thus, whatever is peculiar to the root, stem, or any other part of the plant, is arranged with the special or particular terms belonging to that part. Whatever applies not only to the root or stem, but to all the parts indifferently, is a general term, and arranges accordingly.

THE language of Botany being now established, it is difficult, by the method just proposed, to give a general signification to such terms which shall apply to every part indifferently. The alteration now offered is rather intended as a specimen of the manner in which the language ought to have been originally constructed, than as a perfect reformation of its present construction. For as the same general term applied to different parts has originally received a different meaning, it is impossible, by new-modelling the method or arrangement, to remove that inconvenience,

convenience, unless by altering the signification of terms, and thus, in effect, instituting a new language.

OF the application of each term, the beginner need not be solicitous for examples : specimens of the most uncommon or remarkable are sufficient ; and frequently a just and precise explanation will supersede the necessity of either specimen or figure.

THE last auxiliary to the beginning Botanist that I shall mention, is the use of those collections of dried plants, generally known by the name of *Herbaria* and *Horti sicci*. In collecting plants for this purpose, care is to be taken that they are not gathered when moist, and that they be kept from moisture afterwards. They are likewise to be compleat in all their parts, even to the minutest organ of fructification. The process of drying, and disposing them on paper, is not subjected to rules, being entirely directed by the fancy of the collector. Some fix the plants to the paper with glue, others stick them into it ; and a third sort fasten them upon it by means of pins. The second method is, in my opinion, preferable ; for the glue proves frequently detrimental to the plants, and if disposed by the latter method, they are always apt to drop out. One plant only is to be placed betwixt each sheet, which ought to have a moderate weight laid upon it, and to be turned at least once in twenty-four hours. When the collection is compleated, or even immediately after it is begun, if agreeable to the collector, the plants are to be arranged according to some approved system ; and the names, both generic and specific, together with some circumstances respecting its history, to be affixed to each species. Linnæus has described a chest capable of containing six thousand dried plants, in which the divisions or cells correspond to the number of classes in the sexual



sexual method, and differ in dimensions according to the greater or less number of species in each class.

THE most considerable collections of this sort in England are, Dr. Sherard's, which consists of 12000 species; and Sir Hans Sloane's, now deposited in the British Musæum, which contains 8000. In France, the most noted are, that of Tournefort, which contains 4000; that of Vaillant, which contains 12,000 species and varieties; and those of Jussieu, and M. Adanson, which contain each about 10,000 species and varieties. These are gardens which flourish when vegetation is no more, which please by the surprizing variety they display, and are rendered eminently useful by the facility with which the natural history of countries the most remote from each other is, by such means, acquired.

SECTION

## S E C T I O N III.

*Natural and Artificial Methods distinguished.*

THE terms System and Method are frequently used, without any precise idea being affixed to either. Before, therefore, we can pronounce with certainty of the merits of any methodical distribution whatever, we must remove this ambiguity, and give a determinate meaning to the words in question.

A SYSTEM then is a mode of arrangement by which a number of detached or complicated ideas are reduced to one simple and general idea founded upon principles demonstrated neither to be absolute nor true, but supposed such, with a view of conducting to some important knowledge, of which we are ignorant. Diametrically opposite to this method of composition, termed Synthesis, is that by which a whole is decomposed into its most simple parts. This mode of reasoning is styled Analysis; and the description of those simple parts which are its object, Definition. What position, or the rule of false, is in Arithmetic, Hypothesis or System is in Physics. In both, the supposition, which is often manifestly false, leads in some cases either directly to the truth, or to some circumstance that is so connected with it, as to render the discovery unavoidable. I say, in some cases, because most commonly such systems lead only to conjectures, to paradoxes, and analogies contradicted by the senses.

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A METHOD



A METHOD is an arrangement of bodies approximated by some agreements or resemblances in the bodies themselves. The idea or principle resulting from these agreements, is general, and applicable to all the bodies indiscriminately; but is never regarded as absolute, invariable, nor indeed so general, as in no case whatever to admit of exceptions.

Thus the sole difference betwixt method and system consists in the different idea which the author attaches to his principles, regarding them as variable and less general in the former, as absolute and invariable in the latter. In excellence, therefore, system must manifestly yield to method, from its extreme uncertainty, and tendency to deceive.

It has been said that a previous knowledge of vegetable arrangement, far from being so necessary as is pretended, does not even facilitate the knowledge of plants: and a ridiculous distinction has been suggested, whereby to know plants *systematically*, and to know them *practically*, have been placed in direct opposition to each other, as subjects, that if not absolutely incompatible, are, at least, perfectly distinct and totally independent. I know but of one case, and that not attended to by the authors of this distinction, in which it can, with any degree of propriety, be vindicated. The rationale of any system, its plan, its principles, may be compleatly acquired, without the previous knowledge of a single plant. I can conceive a novice in what is called the practical part of Botany a compleat master of the theory: in so far the theory is independent of the practice. But will it be seriously affirmed that the practice is equally independent of the theory? Or can it be pretended that there is a man to be found thoroughly versed in plants, and yet totally ignorant of the principles of Botany or systematic arrangement? What then is the  
practical

practical knowledge of plants so much insisted on? An application of the principles of arrangement, which, however independent of that knowledge, is only useful as it conduces to its advancement. Suppose an ignorant nursery-man, pluming himself upon the knowledge he had acquired at second-hand, of the few plants raised in his garden from seeds which, together with their names, had been transmitted to him from different countries, should assert the superiority of his practical knowledge, as he would undoubtedly term it, and throw the most illiberal invectives on scientific principles which he had not capacity to comprehend, I would stop his career, by enquiring in what his so much boasted knowledge consisted, and whether it was at all communicable to others? To this last interrogatory he would doubtless reply in the affirmative; and yet the truth is, that such a pretender to science cannot distinguish between one plant and another, nor of consequence, communicate to others his cause of knowledge. When he sees a *Magnolia*, a *Kalmia*, a *Browallia*, he remembers the names by which the plants in question have been transmitted to him; but it is the names only that he remembers: for ask him by what invariable marks or characters he recognizes such and such plants, his silence as well as surprise give conviction of his ignorance. Such is the practical knowledge of plants that is acquired independently of systematic arrangement!—a knowledge which is neither distinctive, nor can be communicated to others, as its cause cannot be assigned.

BOTANISTS have distinguished two kinds of methods, natural and artificial. The excellence of the former has been fully commemorated by almost every writer on Botany. Its classes or primary divisions are true natural families founded upon numerous, permanent and sensible relations, which are essentially the same in all the plants of each particular family or assemblage.



Thus the whole vegetable kingdom is distributed by nature into a sort of progressive scale, the classes or divisions of which run insensibly into one another, as do likewise the several individuals of each class. It is not therefore only the natural families which it imports us to know; we must also detect the order which nature observes in arranging them, and connecting the several individuals with one another. It is this which makes the discovery of that great desideratum in Botany, a natural method, almost impracticable: for whilst links in the great chain are either misplaced or deficient; whilst chasms remain to be supplied; in a word, whilst a single plant remains undetected, the order of nature must still be involved in obscurity, and our knowledge of the natural tribes that have been already distinguished, rendered, in some sort, useless. Thus the principal impediment to the discovery of a natural method, it is only in the power of industry, by a proper exertion of its talents in the detection of new species of plants, to lessen or totally remove. Animated as I would wish every botanist by so encouraging a circumstance, I cannot help expressing my doubts, that, if detected, such a natural method as that I have been describing, would not greatly facilitate the knowledge of plants. The fact is, that the different genera of each family or tribe are connected by such numerous relations, that, though possessed of the order of nature, we should be apt to mistake one genus for another, nay not seldom to incorporate all the genera of one natural family into one huge genus. It is in this way that the genera of the lip, pea-bloom, cross-shaped flowers, and some other natural orders of plants, are not distinguished but with the utmost difficulty: an inconvenience which is greatly increased from this circumstance, that the genera in such orders are frequently numerous. When I see a species of sage, germander, bugle or lavender, the figure and situation of the flower, and general habit of the plant immediately determine me:

me to refer each to the natural order of lip-flowers, or of plants which flower at the joints: but this is the only thing which I can immediately determine; for upon viewing the numerous list of plants which arrange themselves under that assemblage or family, I discover so many resemblances and so few differences, that I am almost tempted to make one enormous genus of the whole, till I reflect that by such proceeding I gain nothing in point of facility, as the trouble thus spared by the diminution of genera is more than equalled by the prodigious multiplication of species. Thus the difficulty of applying a natural method, although, in fact, extreme, is not immediately perceived. For as a plant, by reason of some conspicuous character, may be referred almost at sight to its proper class or division, we are not apprized of the difficulty, till, upon examining the genera, we find the agreements so numerous, and the differences consequently so minute, that discrimination seems almost impossible, and we remain as ignorant of the plant to be explored as at first. As a proof of this assertion, it deserves to be remarked that those methods which have approached most nearly to the natural, either in the plan or execution, have been uniformly found the most difficult in practice. Such methods indeed are doubly intricate, because all the classes not being strictly natural, it is frequently as difficult to ascertain the class as the genus. Besides, as the classes in such methods must necessarily be numerous, for the purpose of collecting all the natural families, it requires a multiplicity of steps to connect them together; and hence the clavis or key of the arrangement is perplexed and intricate. The learned reader, when he hears the names of Morison, Ray and Magnolius, quoted upon this occasion, will agree with me in the fact and in the cause which produced it.



As the order of nature is uniform, general and universal, that is, admits of no exception; but being totally independent of our will, is regulated by the nature of things, which consists in the combination of all their parts and qualities; it is evident that there can be no natural method in Botany but that which arises from a combined view of all the parts of plants, and their relations. Into this view must enter the roots, stems, leaves, flowers, fruit, general habit; in fine, all the parts, qualities, properties and faculties of plants. From the symmetry of these parts, from their figure, number, situation and respective proportion, and from a comparison of their qualities, agreements and differences, arises that affinity which approximates plants, and distinguishes them into natural Classes or Families. This idea, however, of a natural method, though most certainly the true one, is very different from that of Linnæus, who, disregarding the habit or external port, and several other circumstances just mentioned, confines himself merely to the symmetry of all the parts of fructification.

AN artificial method collects genera which do not possess the greatest number of relations necessary for approximating them to one another, although they agree in the characteristic mark or marks assigned to each class. From this definition it is evident that the characters employed in artificial methods, because less numerous, are simpler than those employed in the natural method. For the same reason, such methods are infinitely more easy; because the genera of each class not being connected by such numerous relations, are easily distinguished from one another: and the classic character generally depending upon a single circumstance, the classes, which, in most artificial methods are proportionably few in number, may be ascertained with equal facility. As nature is uniform in all her operations, there can be  
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but one natural method ; whereas the number of artificial methods is almost inexhaustible, arising from the combination of the different parts of plants, their figure, number, proportion, situation and other circumstances.

I CANNOT better illustrate the difference, in point of facility, between natural and artificial methods than by reminding the reader of the two different ways of arranging words in a dictionary. The most natural method of arranging words would doubtless be to place all derivatives under their primitive, and all compounded words under their simple root. Such rational dictionaries, however, would be by no means useful to learners, nor answer the purpose that nomenclatures of this kind are intended to serve. Artificial dictionaries therefore were invented, in constructing which, no sort of knowledge whatever was presupposed in the beginner, save that of the order of the alphabet merely: A boy who knows his letters, and the order of their succession, can turn up any word you dictate full as quickly as if compleat master of its derivation and etymology. There is no science required. It is an easy succedaneum for the rational dictionary just mentioned, which, however excellent, could only be useful to the learned, to whom the derivations and compositions of words are familiar. Artificial methods are to the natural, what the alphabetical dictionary is to the etymological. The characteristic marks of the classes correspond to the letters of the alphabet, and the order of their succession: the natural families and the order of their arrangement, to the etymological arrangement of words. The analogy is strong ; and the difference, in point of facility, may be explained, in both cases, on the same principles.

FROM



FROM the definition delivered in the beginning of this section, it is evident, that every system must be artificial, because its principles are supposed to be absolute and true, but not demonstrated such. These suppositions may indeed sometimes be realized in the sequel, and demonstrated to be true: in which case they cease to be systematic principles, and become part of the natural order of things. It was this which happened to the planetary system of Copernicus, when a sufficient number of observations had confirmed beyond a doubt the relative disposition in the orbs of the solar planets, which that system had set out with supposing.

SYSTEMATIC Botanists are divided by Linnæus into two classes, termed *Orthodox* and *Heterodox*. The former have arranged plants by a method founded on some part of the flower or fruit: I say, on some part, because the choice is arbitrary, though some of the parts are manifestly preferable to others. Heterodox Botanists are such as have distributed plants from some part or circumstance unconnected with fructification. Such were most of the writers during the rude state of the science: such even are some modern authors of eminence, as Sauvage and Duhamel, who have suggested an arrangement from the leaves; and Miller, who less philosophically still, has digested the plants he describes in alphabetical order. The numerous methods founded on the external habit or port, the time of flowering, place of growth, medicinal powers and some other circumstances, are equally contrary to the genuine orthodox principles of systematic arrangement with those of the authors just mentioned. The first orthodox Botanist was Cæsalpinus, a professor at Padua, who, in 1583, gave rise to the systematic æra of Botany, by the publication of an arrangement of plants founded upon the fruit, the idea of which he had received

ceived in 1560, from Conrad Gesner, an eminent physician of Switzerland.

As the following section will be solely employed in tracing the progress of method from its first and simplest rudiments in botanical writings to its present more improved state, it would be improper to enlarge farther in this place upon the distinction which has just been suggested. I shall therefore dismiss this section with an explanation of the terms Universal, General and Partial Methods which frequently occur in dissertations on botanical subjects.

AN universal method is that which includes all the plants known at the time of its establishment. Of this kind are the methods of Bauhin, Ray, Tournefort, Linnæus and many others.

A GENERAL method is conversant, like the former, about all the different classes of plants, but limits its researches to a particular spot, region or country, without including all known plants. Of this kind are those enumerations of the native vegetables of any particular place or country, generally known by the name of Floras. These catalogues, for they are no other, have multiplied exceedingly of late years; and it requires only a very flight acquaintance with the subject to divine the cause. When books can be made with so very little trouble as transcribing occasions, all the world may turn authors. The catalogues in question have certainly their use, and, in proper hands, might prove of eminent advantage, by being enriched with many valuable observations respecting the natural history of the several countries and provinces whose plants they enumerate. But at present they are little else than mere transcriptions from the *Species Plantarum* of the generic, specific and synonymous names of



plants, with scarce a single remark worth attention, or one deviation from the beaten path, which might display ingenuity. The evil of this is, that illiterate people, tempted by the facility of such an undertaking, may commence authors, and wading beyond their depth, contribute as effectually to mislead the public, through vanity, as others through design. From this censure I would particularly exempt the ingenious M. Gouan, who both in his enumeration of the plants which grow naturally around Montpellier, and in his catalogue of the indigenous and exotic plants that are reared in the botanical garden at that place, has usefully deviated from the common track, and, among several other interesting particulars, prefixed to each genus its secondary characters, or those derived from the habit and general appearance of the plants which compose it.

PARTIAL or particular methods are limited to the examination of a single class of plants. Such are Vaillant and Pontedera's arrangement of the compound flowers; Morison and Artedi's division of the umbelliferous plants; Ray, Monti, Scheuchzer, and Micheli's arrangement of the grasses; those of the mosses, mushrooms and flags by the last mentioned author, Dillenius, Gleditsch and Battarra.

## SECTION



## S E C T I O N   I V .

*The progress of Method and Systematic Arrangement from its simplest Rudiments in Botanical Writings.*

THE distinction of Heterodox and Orthodox Botanists, suggested in the close of the last section, serves very properly as a foundation for the method to be observed in this. The first writers on plants, studious to render Botany useful, were little solicitous about means to facilitate its knowledge. They collected the names of plants, their virtues, and æconomical uses, and made what additions they could to the scanty original list. Mean while, arrangement lay either totally neglected, or, founded upon insufficient principles, was little calculated to instruct. The period during which Botany continued in this uncultivated imperfect state, I have chosen to design by the name of the Historical Æra; because the knowledge which it inculcated, being confined to the names, number and virtues of plants, was professedly of the historical kind. The other æra, which commences with Cæsalpinus, is properly denominated the Systematic Æra of the Science, from the orthodoxy of its methods, and genuine purity of the principles on which they proceed.

THE Historical Æra opens with Theophrastus, who is very properly considered as the Father of Botany. For although, prior to the time of that elegant Naturalist, several writers are said to have mentioned plants occasionally, and even to have given descriptions of them; yet such descriptions are either loose and de-



sultory, or have perished with the works in which they were contained. In this light we are to regard the writings of Zoroaster the Persian; those of Orpheus, Musæus, Hesiod, Homer, Solon, Pythagoras, Cratevas, and Hippocrates among the Greeks; and among the Jews, those of Moses and Solomon, the last of whom is said “to have spoken of trees from the cedar that is “in Lebanon, even unto the hyssop that springeth out of the “wall.” The greatest part too of Aristotle’s two books on plants, which are frequently quoted by himself, has perished in the general wreck of time; and the little that has escaped its undistinguishing fury has been so mangled and torn by the unskilful, under the specious pretext of supplying its defects, that we have only to lament, that the original work was not either totally preserved, or totally lost.

THEOPHRASTUS, the disciple of Aristotle, was born at Ereum in the island of Lesbos, and flourished in the third century before the Christian æra, being about 100 years posterior to Hippocrates. His work, entitled the History of Plants, is executed in a truly philosophical manner. It treats of vegetation, of the origin and propagation of plants, of their anatomy and construction, and of vegetable life. In a dissertation of this nature, professedly confined to the philosophy of plants, it would be highly absurd to expect a numerous catalogue, or a studied well-digested plan of arrangement. The number of plants which his subject led him to describe or mention amounts to about five hundred. These he has arranged by a method, which, however unsystematical, seems extremely well suited to the rude state of the science, and was indeed partly suggested by his main subject. The work in question originally consisted of ten books, one of which is lost. In the remaining nine, vegetables are distributed into seven classes or primary divisions, which have for their object the generation of  
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of plants, their place of growth, their size, as trees, and shrubs; their use, as pot-herbs and esculent grains; and their lactescence; which last circumstance respects every kind of liquor, of whatever colour, that flows in great abundance from plants, when cut. In this short view of Theophrastus's History of Plants, I have confined myself merely to his method of arrangement. As a philosophical treatise on the laws of vegetation, its eminence is indisputable. The diction is remarkably elegant, and withal so perspicuous and easy, that a strict perusal of the original cannot be too warmly recommended to botanists who have studied the Greek language; I say, the original, because there are many inaccuracies and errors in the best translations, owing to an ignorance in the translator of the terms of botany.

THE next Botanist of note was Dioscorides, by birth a Grecian, but under the Roman empire. The number of known plants, their virtues, and the names by which they were distinguished both in Greece and the adjacent countries chiefly employed the attention of this indefatigable botanist. That the science, however, was still in its infancy, appears from this remarkable circumstance, that, although near four hundred years posterior to Theophrastus, and professedly a collector, Dioscorides has not been able to enumerate above six hundred plants, five hundred of which were described or mentioned by the Father of Botany. In the writings of Dioscorides we do not recognize that elegance of diction and those graces of manner which characterize his predecessor. His style is simple, plain and devoid of ornament. The descriptions, nevertheless, although imperfect, are preferable to those of the other, because the characters which they collect are more numerous and invariable. Plants were arranged, by this author, from their uses in medicine and domestic œconomy, into four classes, which are thus designed; Aromatics, Alimentary  
Vege-



Vegetables, or such as serve for food ; Medicinal and Vinous Plants. To observe on the impropriety of such a mode of arrangement, is altogether unnecessary. In fact, the qualities and virtues of plants can never afford genuine distinctive marks, because neither fixed and invariable, nor impressed in legible characters upon the bodies themselves. The different parts too of a plant often possess different and even opposite virtues ; so that, supposing such virtues to be known, and to be misapplied to the purpose of vegetable arrangement, the root must frequently fall under one division, the leaf under a second, the flower and fruit under a third. Besides, if we reflect that the sole end of such arrangement is to facilitate to others the knowledge of plants, the insufficiency and even absurdity of methods founded upon their virtues will quickly appear. A stalk of vervain is presented to me, which I am to investigate by a method that has the virtues of plants for its principle. How am I to proceed ? Before I can settle the class under which it is arranged, I must discover its virtue ; and such discovery being the result of repeated experiments on various parts of the human body, may require years for its accomplishment. Thus such methods of distribution are totally useless in investigating plants, and therefore highly improper to be employed. A genuine distinctive character founded on the external parts, which a little instruction soon renders familiar, will cut short this work of years, and determine almost at sight the class, genus and species of the plant in question. In the first case there is no principle whatever upon which to proceed ; in the second the ground is sure, because the external parts are always present, and always obvious to sight. The structure of the root, stem, leaves, flower and fruit, is an object of sight, and can always be recognized : the virtues and medicinal powers of plants afford no distinctive character, and cannot be recognized without a series of experiments made expressly with that view.

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It deserves likewise to be remarked, that the virtues of plants employed in medicine have been much better ascertained since the introduction of genuine systematic arrangements than at any former period : and it is more than probable that the nearer we approach the order of nature, with greater certainty and facility shall those virtues be detected. The powers and sensible qualities of a single plant of any of the natural families being discovered, those of the rest no longer remain concealed ; as so many circumstances of resemblance in the external structure may well induce something more than conjecture that their qualities and effects upon the human body cannot be very dissimilar. And, indeed, it is its extreme importance to physic, that renders the discovery of a natural method in Botany, so desirable an object : considered merely as an arrangement, whose chief object is to facilitate the knowledge of plants, it must yield the preference to many of the artificial methods already known. This is demonstrated at large in the preceding section.

THE same causes which render methods founded on the virtues of plants, unfavourable for the purpose of investigation, must evidently disqualify all their other variable qualities and accidents from holding a place in a genuine distinctive systematic arrangement. The *natale solum* of plants, which is one of Theophrastus's divisions, affords no more a distinctive character than their powers and virtues. Many countries, as well as many soils, produce the same individual plants. The same species which crown the mountains, frequently cover the fens : and plants which have long been reckoned the peculiar inhabitants of some parts of Asia and America, are now found to grow naturally in equal perfection in the very different climates of Lapland and Siberia. In fine, however useful the natural soil and climate of plants may  
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be in gardening, they are circumstances of no utility whatever, when employed as the foundation of a mode of arrangement.

THE size of plants, which suggested the ancient division into trees and shrubs, is no less an equivocal mark of distinction than the circumstances already mentioned. The vine, which modern botanists denominate a shrub, was ranged by Theophrastus in his third class, containing trees. In fact, every thing respecting size is so much affected by differences of soil, climate and culture, that the same plant, in different circumstances, shall differ exceedingly in height, and, in a method founded upon that accident, be arranged sometimes as a tree, sometimes as a shrub, and sometimes even as an under-shrub, according as it exceeds, equals, or falls short of a given standard.

No less insufficient and despicable are characteristical marks drawn from the sensible qualities of plants; I mean their colour, taste and smell.

OF all the attributes of vegetable nature, colour is perhaps the most inconstant. Heat, climate, culture, soil, and a thousand circumstances contribute to produce almost endless diversities in that quality, and render the transition from one colour to another natural and easy. Red and blue pass easily into white; white into purple; yellow into white; red into blue; blue into yellow. In the same leaf or flower are frequently observed several different colours. Variations too in point of colour are often found to take place, not only in different individuals of the same species, but likewise in similar parts of the same individual plant. Marvel of Peru and Sweet William produce flowers of different colour upon the same stalk.

OBJECTIONS equally valid lie against taste and smell. The former varies in different individuals from differences of age; and even in the same individual, at different times, according to the morbid or sound state of the organ. The latter is different in different subjects, and varies in each. The effluvia sent forth from the same body are not always of equal intensity; which is the reason that dogs discover their masters in a crowd with much greater facility at one time than another. In plants, taste is subjected to continual variations from differences of climate, soil, and culture. Garlic, in some climates, particularly in Greece, is said to lose its rankness; apples and pears that grow naturally in the woods are intolerably acid; celery and lettuce, which culture renders sweet and palatable, are, in their wild uncultivated state, bitter, disagreeable, and, in some cases, noxious.

ALMOST cotemporary with Dioscorides flourished Antonius Musa; Cato, Varro, Virgil, and Columella; the first, author of a treatise still extant on the plant betony; the four others celebrated for their useful tracts on agriculture and the œconomy of rural affairs.

PLINY the elder, who is generally reckoned posterior to Dioscorides, scarce merits a place in a review of this kind. His work, entitled a History of the World, is a compilation from the writings of all his predecessors in every branch of natural knowledge. The botanical part of this voluminous undertaking is included in fifteen books, which, besides the plants of Theophrastus and Dioscorides, contain descriptions of several new species, extracted, in all probability, from works which would have been totally lost, but for the laudable industry of this indefatigable compiler. Pliny uses scarce any mode of arrangement, save the very incorrect, though ancient, distinction into trees,

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shrubs



shrubs and herbs. His subjects are exceedingly multifarious, and extend, not merely to botanical distinctions, but to gardening, agriculture, and whatever is connected either more nearly or remotely with the science of plants. In an immense compilation of this kind from authors of very different merit and credibility, we are not to be surprized, if all the facts are not equally authentic, nay, if some are absolutely contradictory. Upon the whole, Pliny, although no botanist, is a valuable and useful writer. His book contains all the natural history of the ancients delivered in a style that is not devoid of ornament: and the botanical part, however badly arranged, gives descriptions or names of upwards of a thousand species of plants: so that about four hundred species are mentioned by Pliny which are not to be found in the writings of Dioscorides; an increase which seems amazing, when it is considered, that the interval betwixt the Greek and the Roman could not have exceeded thirty years.

As it is the professed design of this section to relate the history, not of botanists, but of botanical methods, I pass over with a bare mention the names of some Romans and Asiatic Greeks, whom I find recorded in this æra of the science as persons addicted to the study of plants, but totally inattentive to the laws of vegetable arrangement. In this light we are to regard the writings of Rufus under Trajan, and those of Palladius under the emperor Antonius Pius. About the middle of the second century appeared Galen, a name not more celebrated in physic than insignificant in Botany. The virtues and medicinal powers of bodies, whether animal, vegetable or mineral, were the favourite research of this author. To this great object he rendered every thing subservient, regarding as useless whatever was not professedly calculated to promote that end. Thus the Botany of Galen, however useful to the student of Pharmacy, is insufficient  
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for investigating a single plant. It supposes every thing, it teaches nothing. Oribasius, another Asiatic Greek, trod in the path marked out for him by his master Galen, but with so little success, that scarce a fourth part of the plants of Pliny was known to this author. To him succeeded Aetius Amydenus, Paulus Ægineta, and Alexander Trallian: the two first compilers; the latter a man of a more free and liberal turn: but the science was in disrepute, and not even a Trallian could revive its drooping head.

THE limited Botany of the ancients, and its rapid decline from the time of Pliny to that of the authors just mentioned, can only be attributed to a neglect of systematic arrangement, which, in facilitating the knowledge of plants, prepares for an investigation of their powers and virtues. It was not till near the close of the eighth century, that the Cimmerian darkness which had diffused itself over this science began to dissipate, and Botany, as well as the other departments of natural knowledge, re-assumed its pristine form. The scene of this first restoration of the ancient Botany, lies in Arabia. Serapio, a well-known name in medicine, stands first in the Arabian catalogue; to him succeeded Razis, the laborious Avicenna, Averrhoës, Actuarius and other names less celebrated. Their works, however, are only translations and compilations from the Greek writers. The genuine spirit of arrangement had not yet obtained. Unable therefore to support itself long, the science sunk into a second oblivion; and the few faint glimmerings which chance had just afforded, served only to make the subsequent darkness appear more horrible.

DURING the ages emphatically stiled Barbarous, the human mind may be said to have suffered a sort of temporary annihila-



tion. Literature languished. Science was no more. In this state of universal torpor, not to be paralleled in the history of mankind, Botany, we may well suppose, shared the general fate, and lay neglected with every other useful art. For four hundred years posterior to Abenguefit, an Arabian physician who flourished in the latter end of the twelfth century, scarce any attempts were made to draw from its obscurity the Botany of the ancients, far less to extend its boundaries, by new researches. True it is, the history of the science commemorates the names of a Myrepsus, a Hildegardis, a Quiricius, a Platearius and a Sylvaticus, who, during the prevalence of barbarism, made some faint efforts to emerge from the general ignorance: but, unequal to the arduous task, they sunk under the mighty load; and the same obscurity has involved them and their works. Little more reverence is due to the names of Cuba, De Dondis, Suardus, Bosco, Villa Nova, and Crescentius, who lived in the fourteenth and fifteenth centuries, and are generally ranked among the number of botanical writers. They wrote of plants indeed; but they wrote of them without method, without language, without knowledge. All was one great chaos; and consummate indeed would have been the labour of that man who could reduce such a mass of confusion into symmetry and order.

ON the revival of letters in the beginning of the sixteenth century, the Botany of the ancients was restored a second time. The Greek writings were translated into Latin, the common language of Europe; and the spirit of free enquiry once more prevailed. Gaza, a Greek refugee at Rome, made elegant translations of Aristotle and Theophrastus, who, in the sequel, were commented on by Scaliger and Stapel. Dioscorides was translated, first by Cornarus in 1557, and afterwards by Sarrazin in 1598. His best commentators are Hermolaus Barbarus, Fuch-

sius,

sius, Ruellius an ingenious Frenchman, Cordus, Gesner, and Matthiolus. The most distinguished commentators of Pliny are, Dalechamp in 1604, Saumaïse or Salmasius in 1689, Harduin and Guilandinus. Meursius and Urfinus have written commentaries upon Cato; Campegius and Monardes upon Mesue the Arabian, and Lonicer upon Avicenna, who has been translated by several writers, particularly Alpagus, Costæus, Plempius, into Latin; and by one writer, Amalthæus, into Hebrew.

HIERONYMUS Bock, or Bouc, a German, generally known by the name of Tragus, is the first of the moderns who has given a methodical distribution of vegetables. In his History of Plants, published in 1532, he divides the 800 species there described into three classes, founded on the qualities of vegetables, their habit, figure and size. The distinctions of Lonicer, Dodonæus, L'Obel, Clusius, Brunfelsius, Monardes, Cordus and some other Botanists of this period were not more scientific, and respected either the medicinal powers of plants, their sensible qualities, æconomical uses, or some of the external parts not connected with the flower and fruit. The insufficiency of leading characters from the virtues, accidents and variable qualities of plants has been fully demonstrated in the preceding part of this section. A certain degree of excellence is possessed by every method, which derives its distinctive characters from any of the external parts: but that excellence is merely comparative, being, in different methods, greater or less, as the parts, by their structure and modifications, seem more or less adapted for the purpose of vegetable arrangement. Characteristical marks drawn from the root, stem or leaves, are superior to those derived from the virtues and qualities of plants, because obvious to sight, and capable of being recognized in the bodies themselves. But characters drawn from the flower and fruit being more uniform and invariable, and there-



therefore of far greater utility in facilitating the knowledge of plants, are superior, in point of excellence, to those derived from the other parts.

THE roots and stems of plants do not furnish sufficient variety of characters to serve as foundations of a mode of arrangement. Botanists have been able to distinguish but three sorts of roots, *fibrous*, *tuberous*, *bulbous*, and their modifications. With so few distinctive characters, what method could be useful? For although by means of such distinctions alone the class of any plant can be immediately detected, it is next to impossible that the genus ever should: Why? because the classes, for want of distinctive characters, being few in number, would be so overloaded with genera, that a combination of all the parts of the plant, and their several modifications would not suffice to discriminate them. It deserves likewise to be remarked, that the root, by being hid under ground, seems of all the external parts, the most improper for the purpose of vegetable arrangement. What could be more inconsiderate than to make our knowledge of any plant depend upon a circumstance which must always injure, and, in many cases effectually destroy it? The trouble too of pulling up plants by the root in order to determine their precise place in the arrangement, must have proved extremely irksome to the botanist, and well nigh compelled him to relinquish a science, so difficult in the attainment. For these reasons, no method that I am acquainted with, claims the roots of plants, and their different modifications for its sole principle: I say its sole principle, because there are some methods, and those since the introduction of systematic arrangements, in which the form of the root is made a characteristic distinction for discriminating a few of the classes only. Equally improper for the purpose of arrangement, because not more numerous, are the forms and modifications of the stem. In trees,

trees, it is hard and woody; in herbs, succulent; in the grasses, hollow and jointed; in the ferns and palms, a ramified leaf, or rather a singular composition of a leaf and branch. These are almost the only distinctions arising from the form of the stem: unless we add, that its figure, generally cylindrical, is, in some plants, angular; and that, in others, it is found to elevate the flower and fruit only, without the leaves.

THE duration of the stems of plants suggested the ancient distinction into herbs and trees; the former, vegetables of a less solid consistence, which lose their stems during the winter; the latter of a firm, solid texture, woody, and subsist, by their stems, during the winter. These last were subdivided by Aristotle and Theophrastus, and afterwards by Clusius in 1576, into Trees properly so called, Shrubs and Under-shrubs. Under-shrubs are defined to be perennial plants with a woody durable stem, whose height exceeds not that of herbaceous vegetables. Shrubs differ from these only in their superior size. Trees properly so called are perennial woody plants, which rise to a very great height, and subsist for many years. Such is the distinction of L'Ecluse; but it is far from being accurate, and, considered as the foundation of a mode of arrangement, has been proved insufficient. Neither are those to be regarded, who, in order to discriminate woody plants, have recourse to the number of stems, combined with their size, and understand by trees, all such vegetables as are of great height, and rise with a single stem; by shrubs, such as rise with several stems; and by under-shrubs, such as have only a single stem, that rises to a very small height. The character ascribed by such authors to shrubs falls oftener to the share of those plants denominated under-shrubs; for although shrubby plants ramify and divide much nearer the ground than trees, yet are they very rarely known to proceed from the roots with more than  
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a single stem. Linnæus has not been more successful with his distinction from the buds : for if by trees we were to understand such woody plants as rise with buds ; and by shrubs, such as have no buds, the very large trees of India, which rarely bear any gems, would, notwithstanding their great height, be denominated shrubs, and arranged accordingly. The truth is, that nature seems to have put no absolute limits between trees and shrubs ; so that a definition cannot be given of the one, which shall not, in some sort, include the other. Thus, trees, shrubs, under-shrubs and herbs form a kind of scale, the degrees of which, like those of the scale of beings imagined by some Naturalists, run insensibly into each other, and elude distinction. It is only, however, in the mean terms of this series that we are to expect any such insensible gradations. The extremes are perfectly distinct, and can never be confounded. But though I allow the distinction of herbs and trees to be sufficiently ascertained, I am far from thinking it proper to be employed as a discriminating classical character. If used alone, it is too general to be of any service whatever : if in conjunction with other characters, it destroys the uniformity of the method. In the former case, the number of classes is reduced to two ; in the latter, there is an unnecessary multiplication of classes, because the same characters which discriminate herbs, serve frequently to discriminate trees also. M. Tournefort, by adopting this distinction, has destroyed the uniformity of his plan, and spun out into twenty-two classes what, without such distinction, might have easily been comprized in seventeen. Want of uniformity, however, aside, there are other reasons which render the duration of plants an insufficient and improper distinction. In many cases, we cannot determine at sight whether a particular plant is of the herbaceous or woody kind ; in the same manner as the size of plants, allowing it to be a sufficient character, could never distinguish trees from shrubs, till each  
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had attained its full and proper height. Young trees and shrubs are not less tender and succulent than herbs; so that an entire revolution of the seasons must frequently elapse before we can be apprized of their genuine nature. On the other hand, many herbaceous plants appear of a hard, solid consistence like shrubs; and to mention no more, there are instances of plants which, from being trees in a warm climate, have become herbs, by being removed into a cold one.

As the duration of the stem serves to discriminate trees from herbs, the duration of the root distinguishes the several kinds of herbaceous vegetables from one another. Herbs which rise, grow and die in one year, are termed Annuals; those which perform the changes of vegetation twice, Biennials; and those which subsist several years by the root, Perennials. Trees and shrubs differ from perennial herbs in that they subsist both by the root and stem.

THE leaves, although much more diversified in their form than either the root or stem, are equally improper for discriminating the classes of plants. Sassafras, and paper-bearing mulberry bear leaves, some of which are perfectly entire, others cut either slightly or deeply into one, two or three lobes. In triple-thorned Acacia the leaves are partly winged, partly double-winged, partly simple. Innumerable are the accidents which produce varieties in the form and situation of leaves, and render such circumstances highly improper to be employed as scientific distinctions. The same plant, in different climates, with different culture, or sowed at different seasons of the year, is covered with leaves that are totally dissimilar. Plants, otherwise nearly related, are found to produce leaves, between which there is no sort of resemblance: and others which differ essentially in figure, qualities and habit,



bear leaves so remarkably similar, that confusion would be unavoidable, if primary divisions were to be erected upon so unstable a foundation. Neither is the situation of leaves, I mean their disposition on the stem and branches, however comparatively fixed, absolutely immutable. In a species of loose-strife, the leaves, which generally stand opposite in pairs, are occasionally produced by threes, fours and fives round the stem. An addition of the like kind is frequently made to the number of partial or lesser leaves, which constitute a compound leaf. In a species of trefoil, the lesser leaves in question, generally three in number, are occasionally augmented to four.

THE root, stem and leaves being thus found singly insufficient, leading characters were sought in a combination of those and the other essential parts of vegetation. This combination, denominated the port or habit, has been no more successful, as the foundation of an arrangement, than the circumstances already mentioned. In detecting the order of nature, such a combination must undoubtedly be employed: in arranging plants with a view to facilitate their knowledge, it is highly improper, because complicated, and destructive of uniformity. In fine, characters drawn from the habit or general appearance, however useful in distinguishing genera and species, are, in my opinion, never to be employed as classical distinctions.

SUCH was the progress of botanical method, when Conrad Gesner turned his eye to the flower and fruit, and suggested the first idea of a systematic arrangement. This ingenious Naturalist, who imbibed his knowledge of plants in the mountains of Switzerland, was early sensible of the impropriety of every plan of arrangement which had been adopted. The classical characters of each method underwent a particular review: and all, from defects

defects peculiar to each, were found liable to censure. In this comparative trial of the aptness of the several external parts for the purpose of arrangement, it appeared wonderful to Gesner that none of the numerous writers on plants had availed themselves of the parts of fructification, which, from their great variety, superior constancy, and extreme importance in perpetuating the species, seemed to merit the preference above every other classical distinction. That Gesner knew the doctrine of the sexes, which supposes the most intimate connection between the flower and fruit, I do not pretend to affirm: but he certainly knew that the fruit was useful in re-producing the plant, and that it always succeeded the flower. Thus a connection, if not so intimate, at least, as indissoluble, was established; and the parts of the flower and fruit were named in conjunction. By the flower was understood that fine, ornamental and beautifully coloured part of the plant, which falls off or withers soon after its expansion, and immediately precedes the fruit, to which it generally adheres. This definition, although it principally respects the petals or coloured leaves, includes likewise the calix or flower-cup; the stamina, chives or threads; and the pistil or pointal-parts which, in the infancy of system, were not deemed of sufficient importance to merit much attention, nor even to be all of them distinguished by particular names. By the fruit was meant that annual part of every vegetable, which coheres, and is posterior, to the flower, and, having attained maturity, lodges itself spontaneously in the soil, whence, when properly nursed, it emerges an infant plant, in every respect similar to its parent-vegetable. In this definition were manifestly included both the seed-vessel, vulgarly called the fruit, and the seeds, which are its essence.

It was in 1560 that Gesner, thoroughly convinced of their sufficiency, proposed to the world his idea of an arrangement



from the parts of the flower and fruit. No plan, however, was established by Gesner upon this principle; the idea was suggested, but the application left to be made by others; and it was not till 1583, that Dr. Andrew Cæsalpinus, a physician of Pisa, and afterwards professor of Botany at Padua, availing himself of the ingenuity of his predecessor, proposed a method which has the fruit for its basis; and thus gave origin to systematic Botany, the second grand æra of the history of the science.

In proposing the parts of fructification as the properest for arranging plants, Gesner communicated no hints respecting the choice that was to be made of some of those parts in preference to others. Each particular organ of the flower and fruit furnishes sufficient variety to serve as foundation of a method: yet all are not equally proper for that purpose. The first systematic writers made choice of the fruit, as being the most essential part of vegetation. Unaccustomed to examine the subject with that philosophical minuteness which characterizes the botanists of these days, they were not aware, that the figure of the fruit is always more liable to change than that of the flower; and that this last being prior to the other, and appearing at a time the most proper for botanical researches, seemed pointed out by nature as peculiarly adapted for furnishing classical distinctions. In summer, when plants are in their highest perfection, and the blooming face of nature invites to these innocent and pleasing enquiries, the man who would attain a knowledge of vegetables, must not think of deriving it from a method founded on the fruit. Such a method will prove an unsurmountable obstacle in his way: the season invites in vain; in vain does inclination lend her powerful assistance; he cannot advance a single step; he becomes chagrined, judges the undertaking impracticable, and abandons it in disgust.

THE parts of the flower having been frequently employed by the first systematic writers, as subaltern distinctions, in discriminating orders and genera, it is evident that the plant to be explored could often not be referred to its proper genus and species for months after the investigation of its class. Suppose a plant ripens its fruit in October, and does not produce flowers till the following May, the class, upon inspection of the fruit, is immediately ascertained, but the plant still remains unknown, and will continue so for upwards of six months after, if the characters of the order or genus have been made to depend on any part of the flower. In some methods founded on the flower, no inconvenience of this kind can exist. The class is always determined by that part of the flower which furnishes the leading character of the method: the orders and genera, which come next to be ascertained, frequently borrow their distinctive marks from other parts of the flower; and if, as sometimes happens, the fruit is made a subaltern distinction, it is generally so combined with some characteristic of the flower, that the genus can, in most cases, be explored with the same facility as the class: I say generally, because in the methods in question, there are instances of generical characters founded solely on the fruit; but besides that such instances are exceedingly rare, they stand vindicated from this consideration, that the progression from the flower to the fruit, is much more natural than that from the fruit to the flower.

METHODS founded on the fruit have another inconvenience, and that not sufficiently attended to. Plants constantly ripen their fruit in those countries where they are native: But do all plants without exception possess the same faculty in every country to which they may accidentally be transported? The fact is otherwise. Many plants that are natives of a very warm climate, neither ripen nor form fruit, upon being removed into a cold one.

Few



Few of the African, Asiatic and West-Indian plants produce fruit in England. A method therefore founded upon the fruit could only facilitate the knowledge of such plants to the inhabitants of the several countries where they naturally grow. To the English botanist it could afford scarce any assistance. The same objection cannot, with reason, be urged against methods founded on the flower; since the influence of climates much colder than that of England has not been able to destroy the faculty of producing flowers in many, perhaps most of the plants that were just mentioned. Neither is the presence of the fruit so necessary a circumstance in some methods which have the parts of the flower for their basis, as in those of the first systematic writers. In the former, as we have said, the generical character seldom depending on the fruit alone, the plant in question may, in most cases, be explored without its assistance: in the latter, the class cannot be ascertained in absence of the fruit: and if the class is not known, it is impossible that the genus ever should.

HAVING said so much in favour of methods founded upon the flower, I should be inexcusably partial not to mention a very striking inconvenience of which they have been productive. The parts of the flower engross the sole attention of modern botanists. Those of the fruit are almost totally neglected. Nothing can be more preposterous or absurd. For without enquiring, with Linnæus, whether the powder inclosed in the tops of the stamina is of sufficient importance to the plant to justify our minutest researches into that organ, the seed-vessel and seeds are confessedly organs of, at least, equal importance, and therefore entitled to an equal share of attention. True, the parts of the flower conduct with greater facility to the knowledge of plants; and, on that account, merit attention as the main agents of vegetable arrangement: but the parts of the fruit are no less deserving

serving our regard, from their own intrinsic worth, their confessed importance in vegetation, and agency in perpetuating the species.

FOR these reasons, the first systematic writers attached themselves to the fruit, in preference to the flower ; and it was not till upwards of a century after Cæsalpinus, the Father of System, that Rivinus, professor at Leipfic, sensible of the difficulties which his predecessors had encountered, and desirous to avoid them, produced another revolution in the science, by proposing a method founded on the regularity and number of the petals. We are not, however, to suppose that, in this long interval, classical distinctions were solely furnished by the parts of the fruit. Characters drawn from the habit or general appearance of plants still maintained their consequence ; and these combined with some of the external parts more or less connected with fructification, served effectually to destroy the uniformity of the methods into which they entered. In fact, System did not all at once attain that degree of purity and perfection to which it has now arrived. It was long debased by an alloy of the grossest kind, which time, and time only, could expel. That alloy is now no more ; the rubbish which choaked up the avenues to the science is removed ; its luxuriances are skilfully pruned ; and System has reached its ultimatum of perfection.

CÆSALPINUS sets out with the ancient distinction of vegetables from their duration into trees and herbs. With the former he combines shrubs ; with the latter, under-shrubs. Trees, the first grand division, are distributed into two classes, from an attention to the situation of the radicle or principle of life in the seed. In some trees, as the oak, elm, beach, walnut, ash, olive, sumach and cherry, the radicle is seated in the *apex* or summit  
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of the seed : in others, as the fig, mulberry, holly, rose, medlar, apple, tamarind, pine, fir, cypress and juniper, its place is in the base. The same beautiful distinction is frequently used by this author as a secondary character in discriminating the sections or orders of herbaceous plants. In the second grand division, containing under-shrubs and herbs, are thirteen classes constituted from the number of seeds, seed-vessels and their cavities or internal divisions. Some plants have only a single seed, as valerian, nettle, hemp, dock and the grasses. These constitute the third class in Cæsalpinus's method. The fourth consists of herbs with an undivided seed-vessel of the apple and berry kind, containing several seeds ; and is exemplified in cucumber, briony, honey-suckle, deadly night-shade, and herb-christopher. The plants of the fifth class agree with the former in having several seeds contained within an undivided case or seed-vessel, but differ in the nature of that vessel, which, in the class in question, is dry, and of the capsule and pod kind. Pink, primrose, swallow-wort and the pea-bloom or butterfly-shaped flowers furnish examples. These three classes exhaust what Cæsalpinus terms his *single principle* of distribution ; the seeds being either single, or contained in a vessel with a single cavity. In the classes which follow, the number of seeds, cases or cells is two, three, four or many. The sixth class contains all the umbelliferous plants, which have two naked seeds ; the seventh, such plants as have a double receptacle for the seeds, that is, a seed-vessel divided into two cells. It is exemplified in madder, mercury, speedwell and most of the cross-shaped flowers. In the two following classes, the plants have a triple receptacle for the seeds, in other words, a seed-vessel divided internally into three cavities or cells : but appearing too numerous to be arranged in one class, Cæsalpinus has, very unsystematically, borrowed distinctions from the roots, and distributed them into two classes, one of which contains fibrous, the other bulbous-rooted

rooted plants. The former, which is the eighth class, is exemplified in convolvulus, violet and St. John's wort; the latter in hyacinth, tulip, lilly, narcissus, and the other well-known liliaceous bulbous-rooted plants. The tenth class stands solitary, and consists of plants which have four naked seeds. Bugloss, lungwort, comfrey, hound's tongue, sage, germander, rosemary, and the other lip-flowers furnish examples. The principle of distribution in the four following classes is the same. In the eleventh, twelfth and thirteenth, the flowers are succeeded by a number of naked seeds: in the fourteenth, the seeds are numerous, but contained either in several capsules, or in one capsule that is divided internally into several cells. The two first-mentioned classes contain all the compound flowers; the thirteenth consists of such simple flowers as have many naked seeds, and is exemplified in ranunculus, adonis, virgin's bower, herb-bennet and cinquefoil. The reader will naturally ask how these three classes are to be distinguished from each other in a method which has not the parts of the flower for its basis. By this certain rule, that in the thirteenth class, the flower is common to all the seeds; whereas in the two preceding classes, each seed has its own proper floret, or, as Cæsalpinus expresses it, the flower is distributed by parts on the top of each seed. The compound flowers arrange themselves into two classes from the different situation of the radicle or heart of the seed, which in some is placed towards the middle, and in others towards the base. The former constitute the eleventh class of this method, and correspond to the radiated flowers of later botanists: the latter, the twelfth, and include compound flowers whose florets are either all flat, or all hollow; such are lettuce, nipple-wort, dandelion, hawk-weed, centaury, saw-wort and thistle. The thirteenth and fourteenth classes have already been illustrated: this last is exemplified in columbine, hellebore, house-leek, navel-wort, poppy, water-lilly, birth-wort and aza-



lea; the four first of which have several capsules; the four last a single capsule with several internal divisions or cells. It only remains to characterize the fifteenth class, which serves as an appendix to the method, and consists of plants that have neither flower nor fruit. The ferns, flags, mosses and mushrooms, which, from our imperfect knowledge of their structure, form a similar division in every method, constitute the concluding class in that of Cæsalpinus.

SUCH are the outlines of the first attempt towards a genuine systematic arrangement. To form a proper estimate of its merits or defects, we must previously ascertain the facility or difficulty with which it conducts to the knowledge of plants: and this we can in no way so certainly determine as by recurring to particular instances. A carnation is presented to me, which I am to refer to its proper class in Cæsalpinus's arrangement. Is the plant in flower? I am immediately at a stand: it can never be reduced to its class in that stage of vegetation. It must have ceased to flower; it must have ripened, or, at least, have begun to form, its seed-vessel or seeds. This preliminary adjusted, my first enquiry is, to which of the two grand divisions does the plant in question belong? In other words, is it a tree, or an herb? To solve this query, I may frequently be obliged to wait for several months; because the answer to it is principally regulated by the duration of the stem. Behold me then at a stand a second time. I know it will be said that this is an exaggerated representation; that I paint imaginary difficulties; and that he must be a novice indeed, who, in such circumstances, cannot distinguish at sight a tree from an herb. I grant it; he would be a novice; but let it be remembered that the sole intention of arrangement is to facilitate the knowledge of plants: the learned need no such auxiliary; it is the novice only that requires it: and that system is undoubt-

undoubtedly the most excellent, which best accommodates itself to the wants of the merest novice—an axiom which, although self-evident, has been so little regarded, that the distinction into herbs and trees was successively adopted by every succeeding writer to the time of Rivinus, by whom it was very properly rejected as uncertain, and unconnected with fructification. To return to my plant. Having no certain criterion of the justness of my determination, I must have recourse to conjecture, a dangerous interloper in science, which much oftener conducts to error than truth. Supposing, however, that I am fortunate enough to guess right, and refer the plant in question to that division of the method which contains herbaceous vegetables: how am I next to proceed? By the determination just given, two classes are entirely cut off; those, to wit, containing trees and shrubs: and I have to seek for my plant among the thirteen classes which remain. The presence of the fruit implying the previous existence of the flower, serves effectually to exclude it from the fifteenth class which consists of plants that have neither flower nor fruit. I now examine the fruit particularly, and discover it to be a single undivided capsule containing numerous seeds. My plant then cannot belong to the third class, the character of which is a single seed; nor to the fourteenth, because although the plants pertaining to it bear numerous seeds, they are contained either in more capsules than one, or in a single capsule with several cells. Its pretensions to a place in the eleventh, twelfth and thirteenth classes are equally ill-founded, because in these, the seeds, though numerous, are naked, that is, have no capsule or case. In the tenth class, the number four; in the eighth and ninth, the number three; and in the sixth and seventh, the number two, predominates; but neither two, three nor four, predominates in the fruit in question: and therefore the plant cannot be referred to any of these classes. There remain



only the fourth and fifth classes, to one or other of which the plant in question must belong. These two classes differ only in the nature of the seed-vessel, which, in the former, is pulpy, in the latter, dry. But the plant to be explored has a seed-vessel that is dry, not pulpy; and is therefore to be referred to the fifth class, the plants of which have numerous seeds contained in a single undivided capsule.

IN this manner are plants referred to their proper class in Cæsalpinus's method, though not all with equal facility. There are some even which, possessing the characters of two divisions, arrange themselves indifferently under either. Swallow-wort is referred by the author to the fifth class, although its double seed-vessel seemed to give it an equal title with the pæony to a place in the fourteenth. Defects of another, though not grosser, nature, deserve likewise to be mentioned. The compound flowers are distributed into two classes by a discriminating character which is not sufficiently conspicuous, the situation of the radicle in the seed. There is a confused jumble too, in the method, of seeds, seed-vessels and cells: and an obscurity as well as ambiguity in many of the scientific terms which render it a perplexed uninviting system. In fine, as a first attempt, the method just illustrated possesses considerable merit, but can never be characterized a convenient easy mode of arrangement.

THE sections, orders or secondary divisions in Cæsalpinus's method are forty-seven in number, and depend upon a variety of parts and circumstances. The principal of these are, the disposition, situation and figure of the flowers; the nature of the seed-vessel or cover of the seeds; the situation of the radicle in the seed; the number of seed-lobes or feminal leaves; the disposition of the leaves, and colour of the flowers. The lactescence

science too or milkiness, which is observed in the compound flowers with flat florets, is made a characteristic distinction, and discriminates the first order of the twelfth class. Thus it is the characters of the classes only which, in the first systematic arrangements, were solely borrowed from the parts of fructification; those of the subaltern divisions were numerous, and respected every part of the plant. Such divisions, to be perfect, should be constituted, like classes, from the modifications of a single part of fructification. There are few methods that are not defective in this respect: and though I would by no means condemn a plan of arrangement for a slight deviation from uniformity in its secondary characters, I can have no favourable idea of the leading principle of any method which compels the use of a multiplicity of characters from different parts of the plant for discriminating the subaltern divisions just mentioned.

It might have been expected that a method founded like that of Cæsalpinus upon genuine scientific principles, would have been immediately adopted by the learned, and, in establishing itself, have totally extirpated those insufficient characters which, during so many ages, had disgraced the science. The fact, however is, that System perished almost as soon as it had an existence: with Cæsalpinus died his plan of arrangement; and it was not till near a century after, that Dr. Robert Morison, of Aberdeen, in Scotland, attaching himself to the principles of Gesner and his learned successor, re-established scientific arrangement upon a solid foundation; and, from being only the restorer of System, has been generally celebrated as its founder. In the long interval betwixt Cæsalpinus and Morison, flourished some eminent names in Botany. The most noted of these are, Dalechamp, author of a General History of Plants; Theodore, surnamed Tabernæmontanus and Thalius, two German writers; Porta, an Italian,



Italian, famous for an arrangement of plants from their relations to the stars, to men, and other animals; Prosper Alpinus, author of a catalogue of the plants of Egypt; Fabius Columna, inventor of many of the botanical terms now used; the two Bauhins; our two industrious countrymen, Gerard and Parkinson; Zaluzianski, a Pole, author of an arrangement from the qualities and habit of plants; Marcgrave and Piso, celebrated for their Natural History of Brazil; Hernandez, equally celebrated for his of Mexico; Passæus or Du Pas, author of an arrangement of plants from the time of flowering, of all characters the most uncertain and insufficient; Johnston; Bontius a Dutchman, author of a Natural History of the East Indies; Aldrovandus, the celebrated Naturalist; and Rheede, Governor of Malabar, and author of the well-known *Hortus Malabaricus*.

THE method proposed by Morison has the fruit for its basis, like that of Cæsalpinus, to which, however, it is greatly inferior both in the plan and execution. It was Morison's great object to investigate the order of Nature, not to fabricate an easy method of arranging plants. Hence his system, devoid of uniformity, is clogged with a multiplicity of characters; the classes are often not sufficiently distinguished from each other; and the key of the arrangement seems totally lost. Morison sets out with a division of plants, from their substance or consistence, into lignous or woody, and herbaceous. The former, subdivided, from their size, into trees, shrubs and under-shrubs, form the three first classes in the method. Herbaceous plants, which constitute the second division, are contained in fifteen classes, which have for their characters, the number, figure and substance of the fruit, the disposition of the flowers, the presence or absence of the downy crown of the seed, termed *Pappus*, the lactescence or milkiness of some plants, the number of petals, and the habit, port or general

neral appearance. The fourth class contains climbing plants which have a pulpy fruit of the berry and apple kind; and is exemplified in passion flower, briony and cucumber. The fifth and sixth contain all the pod-bearing plants; and correspond to the pea-bloom and cross-shaped flowers of later botanists. Pods are of two kinds; the one, termed *Legumen*, has two valves or openings, and but one cell: the other, *Siliqua*, has two valves, and the same number of cells divided by a partition that runs either parallel to the valves, or in a contrary direction. The leguminous plants constitute the fifth; the siliquose the sixth class, in Morison's method. The seventh class contains plants with six petals and a tricapfular fruit, by which the author means a single capsule with three internal cavities or cells. All the liliaceous or bulbous-rooted plants are referred to this division. A variety of plants are made to arrange themselves promiscuously under the eighth class, without any fixed or precise distinction. The number of petals and cavities of the fruit is announced in the title as the discriminating character. In the two next classes are placed all the compound flowers, which stand thus distinguished. Those of the ninth class, termed *corymbiferous*, from their growing in clusters like ivy-berries, have neither a downy crown to the seed, nor a lactescent or milky stalk: those of the tenth on the other hand, have either a lactescent stalk, or a downy crown to the seed. The former class is exemplified in tansy, wormwood, daisy, fever-few, and milfoil; the latter in succory, hawkweed, dandelion, ragwort, and thistle. Under the eleventh class are arranged the numerous tribe of grasses, whose characteristic distinction in this method is a single seed to each flower. The twelfth class contains the plants termed *umbelliferous*, which have two naked seeds joined at their origin, and whose flowers consist of five petals, and grow in an umbel. A three-corned capsule with three cells, each containing a single seed, characterizes the thirteenth class,



class, which is exemplified in spurge, and palma christi. The fourteenth consists of plants which have flowers with one petal, and four naked seeds. It includes both the lip-flowers and rough-leaved plants of Tournefort and Ray. In the fifteenth are placed such plants as have either more than one capsule, or a single capsule with several cells. It corresponds to the fourteenth class in Cæsalpinus's method, and is exemplified in pæony, house-leek, and water-lilly. The sixteenth class contains berry-bearing plants which do not climb. Deadly night-shade, arum and cyclamen, furnish examples. The ferns, a well-known tribe of plants, occupy the seventeenth class, by the name of capillary herbs: and in the eighteenth, which serves as an appendix to the method, are placed the mosses, mushrooms, sea-weed, several aquatic, and some other, plants which cannot be referred to any of the foregoing heads.

FROM this synopsis the reader may form an adequate judgment of the method under review. It is, indeed, of all others, the most difficult in practice, and was therefore not adopted by any succeeding writer, except Bobart, who, in 1699, compleated Morison's Universal History of Plants, and an anonymous author, whose work appeared in 1720. The fourth and eighth classes possess no genuine distinctive character. With the umbelliferous plants are very improperly joined drop-wort, meadow-rue and the *starry* plants of Ray, which last have one petal with four divisions, the flowers not disposed in an umbel, and the leaves placed in whorls resembling a star round the stem. The ninth and tenth classes, containing compound flowers, are not sufficiently distinguished; in the latter too are arranged teazel, eryngo, pine-apple, protea, and melon-thistle, which have neither a downy crown to the seed, nor a milky stalk, the discriminating characters of the class in question. Garden burnet and plantain are made to ar-  
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range themselves with the grasses, although in the former, two, in the latter, several seeds succeed each flower. With just as little propriety are wood-sorrel, strawberry, cinquefoil, ladies mantle and barren-wort, which bear no pods, referred to the class containing leguminous plants; and anemony, ranunculus and herb-bennet, which have several naked seeds, to the seventh class, consisting of plants with a capsule that has three internal divisions or cells. The fifteenth class is not sufficiently distinguished from the eighth, nor the sixteenth from the fourth. In this last, the characteristic distinctions are a seed-vessel of the berry or apple kind, and a climbing stalk; and yet the title of the very first section, or sub-division of the class, announces the presence of berry-bearing plants which do not climb. To the same class are improperly referred bind-weed, quamoclit, hop and heart-seed which have not a berry for their seed-vessel.

MORISON'S sections or secondary divisions, which are one hundred and eight in number, arise from the figure and substance of the fruit, the number of seeds, leaves and petals, the figure of the root, the direction of the stem, the colour of the flowers, the place of growth, and, in one class, from the medicinal virtues of some of the plants which compose it.

It is remarkable, that, altho' Morison set out with the professed design of investigating as many of the natural classes as possible, he has been able to discover but two that are compleatly so. These are the thirteenth, which, however, contains but two genera, and the seventeenth, comprehending the ferns. Some of the other classes, particularly those containing the leguminous, filiquose, and umbelliferous plants, and the compound flowers, have forfeited their title to that appellation, by being encumbered with



several plants, between which the relations are not sufficiently numerous.

IMPERFECT as is the mode of distribution proposed by Morison, it has furnished many useful hints, which later botanists have not failed to improve. Ray, Tournefort and Linnæus, those great luminaries of the science, have successively owed him much, nor are ashamed to acknowledge the obligation. The first-mentioned writer proposed his method to the world, in 1682, two years after the publication of Morison's, which served, in some sort, as its basis. It originally consisted of twenty-five classes, two of which respect trees and shrubs, and the remaining twenty-three herbaceous plants. This method Mr. Ray carefully retouched, corrected and amended at different times; so that the plan of arrangement which now bears the name of that author, and was first published in 1700, is entirely different from that which had appeared in 1682. The thirty-three classes of which the improved method consists are derived from the port or habit of plants; their greater or less degree of perfection; their place of growth; the number of seed-lobes or seminal leaves, petals, capsules and seeds; the situation and disposition of the flowers, flower-cup and leaves; the absence or presence of the buds, flower-cup and petals; the substance of the leaves and fruit; and the difficulty of classing certain plants.

THE distinction into herbs and trees, with which Ray's method sets out, acknowledges a different, though not more certain, principle, than that of Cæsalpinus and Morison. The former, in making this division, had an eye, with the ancients, to the duration of the stem; the latter, to its consistence. Ray has called in the buds as an auxiliary, and denominates trees all such plants as bear buds; herbs, such as bear no buds. The objection which  
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lies against Linnæus's distinction into shrubs and trees from the same principle, may be still more powerfully urged in the present case : for though all herbaceous plants rise without buds, all trees are not furnished with them : many of the largest trees in warm climates, and some shrubby plants in every country, being totally devoid of that scaly appearance which constitutes the essence of a bud.

HERBACEOUS vegetables, which constitute the first grand division, are distributed into a double phalanx of plants which bear flowers, and such as are devoid of flowers. This distinction was substituted in the improved method for that less philosophical one of perfect and imperfect plants, which had been originally employed. The four first classes exhaust the division arising from the absence of the flower. Of these the submarine plants occupy the first ; the mushrooms, mosses and ferns, the remaining three. Submarine plants are such as grow in the bottom of the sea, or upon rocks that are surrounded by that element. They are either of a very hard stony nature, as the plants termed Lithophyta ; of a substance resembling horn, as the corallines ; or of a softer, herbaceous texture, as the fuci, sponges, and sea-mosses. The corallines have successively passed through each of the three great classes or kingdoms of Nature. Some Naturalists have not scrupled to refer them to the mineral kingdom ; the greater part have arranged them with vegetables ; and it was not till lately that their real nature was clearly ascertained, and they demonstrated, by a series of well-attested experiments, to be true ramified animals. The animality, if I may use that expression, of this singular tribe of natural bodies had been just hinted at by Imperati, an Italian, in 1599, and afterwards, by Peyssonel in 1727 ; but it is to M. Bernard Jussieu, a French academician, and the ingenious Mr. Ellis, that we owe decisive facts, and a regular detail upon this



subject. The former, in several papers to be found in the Memoirs of the French Academy of Sciences for 1741, has demonstrated these marine bodies to be true animal productions; the latter, in his Natural History of Corallines, has, with indefatigable labour, parcelled them out into their several genera, by means of fixed, invariable characters obvious in their appearance.

THEIR place of growth, which is out of the water, serves to discriminate mushrooms, mosses and ferns, the three remaining classes of plants that want the flower, from the submarine productions which constitute the first class. But how are they distinguished from one another? Of all the vegetable tribes, mushrooms are the least certainly known. With the more perfect plants, indeed, they possess scarce any characters in common. They have no leaves; in colour and texture they generally differ from herbaceous plants: and it was not till 1729 that Micheli discovered in some of them appearances resembling stamina and seeds. Most of them attain the highest perfection of their nature in a very short space of time, and disappear with proportionable celerity. Mr. Ray subdivides the mushrooms into two orders or sections; the one containing such as have the under part of the crown or hat divided into *Lamellæ* or thin plates; the other such as exhibit no appearance of this kind. In the first order the hat, which is generally supported by a footstalk, does not possess the same consistence throughout. The upper surface is homogeneous, undivided, and generally of the same colour internally with the footstalk: the lower is most commonly of a different colour, and divided into thin plates. Mushrooms which have nothing analogous to the thin plates just mentioned, are of various forms: some are of a substance resembling parchment or leather, as Jew's Ears; others imitate in consistence a honey-comb: some are club-shaped, some round, some branched. In both orders there  
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are parasitic plants, which draw nourishment from the trees that support them. Jew's Ears is produced upon the elder; agaric upon the larch. Truffles, known among botanists by the name of *tubera terræ*, are produced under-ground. Ray's characters of the mosses are not in the spirit of genuine systematic arrangement. The fructification of that numerous tribe of plants had not then been discovered; so that a general description of the class was necessarily substituted for true scientific distinctions. Mosses are defined to be vegetables of extreme minuteness, and of a dry, arid substance, which grow upon stones and trees, in squalid barren places that are burnt up by heat, or impoverished by cold. They possess likewise the singular property of resuming their original verdure, by immersion in water, after having been dried for years; and are so slow in transmitting heat and cold, that it is found convenient to employ them in preserving dry such bodies as are susceptible of moisture, and in retaining the humidity of young plants, which are to be transported to a great distance, without exposing them to putrefaction. The *antheræ* and seeds of the mosses were detected by Dillenius in 1719 and 1741. At the first publication of his method, Ray considered the ferns as a sort of ramified leaves, and hence adopted for their distinctive character, the absence of the stem. In the sequel, however, he was convinced that the character in question, however proper for discriminating the European ferns, was altogether inadequate for distinguishing those of India and America, many of which have true genuine stems. Obligated then to abandon his first and most obvious distinction, because wanting in universality, he had recourse, in his improved method, to the minute organs of fructification, which, by the industry of some lovers of the science, had begun to be investigated. The illustrious Tournefort, whose method and judicious distribution of the genera furnished Ray with the greatest part of his corrections and amendments, had, in ar-

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ranging the ferns, described them to be plants wanting the flower, but furnished with seeds, which grow upon the back of the ramified leaf or stem. Neither of these characters, nor both in conjunction, appeared to Mr. Ray satisfactory. Professor Rivinus, Mr. Ray himself, and Father Plumier had, by this time, discovered the flowers of some of the ferns; and were hence led by analogy to conclude their existence in all. The last mentioned author, in particular, describing a shrubby American fern, says, that the feminal knobs on the back of the leaf appeared to be preceded by very small florets of one petal, within which were a number of exceedingly minute filaments or threads. The other distinction employed by Tournefort respecting the place of the seeds, seemed equally improper. In royal osmund, or flowering fern, and adder's tongue, the middle rib overtops the leaf, and forms a footstalk for supporting the panicle or head of flowers. Thus the seeds are always seated upon the leaves, though not always upon their back or lower surface. Mr. Ray, therefore, to avoid all altercation, and render the distinctive character as exact as the nature of the tribe of plants would admit, has corrected Tournefort's description, and, in the improved edition of his method, defined the ferns to be plants with a very minute dusty seed, which always grows on the leaves, and generally on their back or under surface. It deserves to be remarked that Ray, although convinced of the existence of the flower in these plants, has arranged them in a division, the characteristic distinction of which is the absence of that organ. The parts in question were neither perfectly distinguished, nor sufficiently conspicuous to entitle the plants to a place in a division where the existence of the flower was, in no sort, dubious. Some ferns produce their seeds on the margin of the lower surface of the leaves, as maiden-hair, and the common female fern, generally known by the name of brakes: but the greater part produce them towards the middle

dle or inner surface; and that either in double rows of iron-coloured points or knobs, as in polypody, and most species of male fern; in vermicular or oblique lines, as in hart's tongue and black maiden-hair; in lines which run longitudinally downwards parallel to the middle rib of the leaves, near which they are placed, as in *blechnum*; or in clusters over the whole surface, as in spleen-wort, generally known by the name of Ceterach of the shops. The stamina and seeds of some of the ferns were discovered by M. de Jussieu in 1739; those of several others by M. Maratti in 1760. Dr. Bobart is said to have been the first who recognized the seeds of this tribe of plants.

WE have now sufficiently illustrated the four classes of plants in which the parts of the flower are either wanting, or obscurely visible, and assigned the characteristic distinction of each class. The division of flower-bearing herbs, which comes next to be evolved, comprehends twenty-one classes; and these the author parcels out into a double phalanx, from an attention to the number of seed-lobes or feminal leaves. To understand the distinction referred to, the reader will please to observe that most seeds have two distinct nutritive lobes that enfold the radicle or embryo-plant, and commonly shoot up out of the soil, for the purpose of defending and nourishing the infant-stem, in the form of two leaves, termed Seminal, because they are immediate productions of the lobes of the seed, and bear no resemblance to the succeeding leaves of the plant. In pea, bean, and the other leguminous plants, the lobes in question are distinctly visible: but in these, it is to be observed, as likewise in the lip-flowers, and some other plants, they remain unchanged, and do not spring up in the form of feminal leaves. Again, there are herbaceous plants, tho' those but proportionally few in number, which have only one lobe to the seed, and rise with leaves perfectly similar in form to  
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the leaves which succeed. This being premised, Mr. Ray's division of the flower-bearing herbs will be clearly understood. Nineteen classes, from the fifth to the twenty-third, both inclusive, contain herbaceous plants which have either two seed-lobes, or rise with two feminal leaves. The twenty-fourth and twenty-fifth classes, the two last in the division under review, consist of plants which have only one seed-lobe, and consequently, do not, like those of the preceding classes, protrude, in germinating, two feminal leaves, of an irregular form, and totally unlike the leaves that are afterwards protruded.

SUCH is the foundation of Mr. Ray's distinction of plants into *Dicotyledonous* and *Monocotyledonous*. The former have two seed-lobes or feminal leaves, the latter but one. In both, the seed-lobe performs the office of the *cotyledon* or *placenta* in animals, by preparing the nourishment, and transmitting it elaborated to the infant plant. Herbs which have two seed-lobes, or rise with two seed-leaves, are subdivided by Mr. Ray into such as bear flowers with petals, and such whose flowers have no petals. This division requires to be explained. The presence of the flower-cup, petals, stamina with their tops, and style or pointal constitutes a perfect flower. The stamina and style are essential to its existence; their absence therefore is incompatible with the idea of a flower; not so the flower-cup and petals; the former of which organs may be wanting, without destroying the perfection of the flower: the latter, though of more importance, does not, by its absence, annihilate the flower, but only renders it imperfect. Upon this doctrine of Mr. Ray is founded the distinction just mentioned. Some herbaceous plants which rise with two feminal leaves, bear flowers consisting of the stamina, style and flower-cup only, without the petals: but in the greater part, the flowers are perfect, that is, consist of stamina, style and petals, with

with or without the cup. If in the second branch of this division no plants found a place that were not absolutely compleat in the parts of fructification, I should not scruple to pronounce it an excellent distinction. But Mr. Ray having arranged with the compleat flowers some which want the calix or flower-cup; and there being no certain criterion whereby to distinguish the calix from the petals in flowers which have only one of the covers present, we shall frequently be puzzled in ascertaining to which branch of the division the plant in question ought to be referred. When both organs are present, there can be no doubt, even although the calix should emulate the petals in colour, texture and fugacity, as it manifestly does in mustard and crowfoot; or even in stability and duration, as in orpine and greater house-leek. In the case alluded to, the calix is always with facility distinguished from the petals by its exterior situation, and use in containing and supporting the flower. But if one of the parts in question only is present, by what rule shall we determine its genuine nature, and whether the organ that is wanting be more or less essential to the perfection of the flower? Let us hear Mr. Ray's sentiments on this subject. The flower-cup, says that author, in his Dissertation on the various plans of arranging vegetables, may always, with accuracy, be distinguished from the petals, by its less delicate texture, its want of colour, and above all, its aptitude to continue till the maturity of the fruit, to which it frequently serves the purpose of a vessel or covering. Hence it is, he continues, that those flowers are to be deemed without petals, in which the parts that surround the stamina are of an herbaceous colour and consistence, or continue upon the plant till the fruit has attained its full size and maturity; those, on the other hand, want the flower-cup, in which the aforesaid parts are either of a different texture and colour, or, devoid of stability, fall off or wither before the ripening of the seed. To take an example. In



the flowers of hop, nettle and hemp, the only cover present is determined to be the flower-cup, from its herbaceous texture and colour; as is likewise that of buck-wheat, bistort and perficaria, from its durability, although, in these last, the part in question exactly resembles petals in its form and colour. None of the characters assigned by Mr. Ray are sufficient to distinguish the petals from the flower-cup. In plants which have both organs present, and it is in such only that we can look for accurate marks of distinction, the flower-cup sometimes falls off, as in the poppy and barren-wort, at the opening of the flower; sometimes with the petals and stamina, as in the cross-shaped flowers. Neither is the same part in all plants of an herbaceous colour; crow-foot, water-cress, gold of pleasure, Indian-flowering reed, broom-rape, calycanthus, and several others, have a coloured calix. In *barbifia*, it is red as blood. Again, in the passion-flower, the petals are of the same herbaceous colour as the calix; in the water-lilly, they are permanent, that is, continue till the fruit has attained maturity; and in the genus *selago*, perform the office of a capsule by inclosing and involving its single seed. The truth is, that nature has placed no absolute limits betwixt the calix and the petals; so that where either is wanting, no rule can be assigned that, in all cases, shall determine, with certainty, the genuine nature of the organ that remains. In some plants, particularly sparrow-wort, star of Bethlehem, white hellebore, spider-wort, and rush, the two organs in question grow together, and are formed into one and the same body; so that the flower, when unfolded, is outwardly of a coarse texture and green herbaceous colour; inwardly, of a fine delicate frame and beautiful colour, which it often changes, when flowering is accomplished, for the herbaceous colour of the under surface, and, in this calix-like form, continues with the fruit to its maturity. This observation is as old as the time of Cæsalpinus. Neither are we, with some botanists,



botanists, to conclude that the petals, because the more excellent organ, are never wanting; since, in flowers which have both calix and petals, the latter is occasionally dropped, the former never. Bell-flower and water-purflane furnish examples of the fact alluded to. M. Tournefort has adopted for his primary and sole distinction of petal-wanting flowers, the durability of the calix combined with its use in serving as a vessel for inclosing and covering the seeds. The former character being proved to be insufficient, the latter, which has no existence without it, can scarce be deemed highly certain. In fine, I cannot help thinking both Ray and Tournefort's distinction of petal-bearing and petal-wanting flowers to be exceedingly improper, because, in no sort, calculated to facilitate the knowledge of plants. At the same time, I can conceive a very easy method of removing the ambiguity, by arranging under one division all plants which are compleat in the parts of fructification, and under its opposite division, such plants as are deficient in either of the two covers of the flower generally known by the names of calix and petals. By such a mode of distribution, a plant is no sooner viewed than its place is finally and certainly determined: if both the organs in question are present, it is referred, without hesitation, to the first division; if only one, we lose no time in enquiring, whether it is the calix or petal, but refer it, with equal facility, to the second.

THE petal-wanting flowers constitute the fifth class in Ray's method. Of these some want both calix and petals, as glasswort, triple-headed pond-weed, and *hippuris*; the rest, which want only one of the covers, are subdivided into such as have the flower placed at a distance from the fruit, and such as have it contiguous. In hop, hemp, nettle, spinach, and mercury, the flower and fruit are produced upon different plants raised from the same seed. In *Ambrosia*, lesser burdock, palma christi, and



bastard ricinus, they stand upon different parts of the same individual plant; the stamina with its cover forming the flower, the ripened seed-bud the fruit. Of petal-wanting herbs which have the flower placed contiguous to the fruit, that is, the stamina situated along with the pointal or style within the only cover that is present, some have a three-cornered seed, as dock, buck-wheat, bistort and knot-grais; some a roundish seed, as orach, blite, pellitory, ladies mantle and rupture-wort; and others, as beet, golden faxifrage, amaranthus and plantain, have their seeds contained in a vessel.

HERBACEOUS plants which rise with two seed-leaves and have petals, come now to be considered. These are contained in eighteen classes, and bear flowers which are either simple or compound. The compound flowers constitute the sixth, seventh, eighth and ninth classes; in the fourteen classes which immediately succeed these, the flowers are all simple. This distribution, which is borrowed from Tournefort, requires explanation. A compound flower, according to Mr. Ray, is an aggregate of several partial or lesser florets, each of which is furnished with its own proper petal, stamina, style and single seed. In a flower of this description, continues the same author, all the florets are contained within a common calix or flower-cup; the seeds are naked, closely arrayed, and placed each under its own proper floret; and there is a circle of larger petals in the circumference or margin of the aggregate, which surround the florets in the middle in the form of rays. By these characters, the author conceives that compound flowers may with facility be distinguished from those modes of flowering termed an *Umbel*, *Corymbus* and *Spike*, with which they might otherwise be confounded. He at the same time cautions us from wrongly imagining that either of the characters just mentioned is singly sufficient to constitute a compound

pound flower. The presence of the two first is absolutely necessary. In fact, there are some flowers, as sea-pink and horned rampions, which, although a real aggregate, and contained within a common calix, are not to be ranked as compound flowers, because each floret is furnished with its own proper calix, and has likewise a capsule for containing the seeds.

THE sixth class of Ray's method contains compound flowers which consist entirely of flat tongue-shaped florets. The plants of this class have a lactescent or milky stalk, and correspond to part of the tenth class in Morison's method. They are distributed by Ray into two sections; the first containing such lactescent compound flowers as have their seeds furnished with a *pappus* or downy crown for their more convenient dispersion; the second, such whose seeds are solid, that is, want the crown alluded to. Lettuce, hawkweed and dandelion arrange themselves under the first section; succory and nipple-wort, under the second. The flowers of this class are defined by Jungius to be such as have plain florets, and are naturally full. The seventh and eighth classes contain the radiated flowers of Tournefort. They are discriminated by the *pappus* or downy crown of the seed, which, in the former, is present, in the latter wanting. On the whole, however, these two classes are the least accurately distinguished both from one another, and from the other compound flowers, of any classes or sections in the method. The ninth class contains compound flowers consisting of several oblong hollow florets, which are generally divided or cut into long segments. This class Mr. Ray has denominated *Capitatae*, because the common calix in the plants pertaining to it swells out, particularly after the fall of the flower, into a prominence resembling a head. Thistle, blue-bottle, burdock and safflower furnish examples. With the compound flowers are very improperly arranged scabious,



bious, teazel, blue daisy and eryngo, which have not all the characters sufficient to constitute a compound flower; each floret in the aggregate being furnished with its own proper calix, altho', like the flowers in question, it is generally placed upon a single naked seed.

HERBACEOUS plants with two feminal leaves and a simple flower constitute the next fourteen classes, and are subdivided from an attention to the seeds, which are either naked, or inclosed in a case or vessel. The number of naked seeds next demands attention; and herein Mr. Ray differs from Cæsalpinus, who made number his primary distinction, subordinate to which was placed that arising from the presence or absence of a vessel for containing the seeds. In the plants of the tenth class, each flower, which is perfect and simple, is succeeded by a single naked seed. Sea lavender, marvel of Peru, valerian and fumatory are adduced as examples. The eleventh class consists of herbaceous plants which bear two naked seeds. These are the plants well known among botanists by the name of Umbelliferous, from the mode of flowering, which resembles an umbrella. The footstalks which support the flowers in this tribe of plants proceed like rays from the same center, and rise to an equal height, so as to form an even surface at top. Each ray too, in most umbelliferous plants, is branched out, near the top, into several partial or lesser footstalks, which support a secondary umbel in every respect similar to the larger or universal one; this last being in fact only an aggregate of the several lesser umbels just mentioned, which altogether form the figure of an inverted cone. The umbelliferous plants are distributed by Ray, from the form of the leaves, which, in some, are simple and undivided; but in the greater number, winged or branched, that is, cut into several lobes or partial leaves. Of umbelliferous plants with divided or dissected

dissected leaves, some have broad compressed seeds, with a leafy wing or border, as cow-parsnep, hart-wort, fennel-giant, and master-wort; in others, the seeds swell out into a different form, and are either very large, of a fungous substance, and contain a kernel, as in *cachrys*; of a spherical figure, as in coriander; long, narrow, and resemble a bird's beak, as in chervil and Venus's comb; furnished with many membranaceous wings that run longitudinally downwards, as in laserwort; long, large and furrowed, as in myrrh, sometimes known by the name of sweet fern; streaked, and of a middling length and thickness, as in spignel, lovage and fennel; hairy, as in carrot; or prickly, as in bastard parsley. Sanicle, hare's ear and black masterwort, are the umbelliferous plants with simple leaves; to these may be added eryngo, which Ray has placed very improperly among the compound flowers. The twelfth class contains plants which, like those of the former, have two naked seeds under each flower, but are in other respects so very unlike the umbelliferous plants, that Mr. Ray has judged very properly in correcting this part of Morison's plan, which jumbled these two classes promiscuously together. The plants in question have their flowers deeply cut into four segments resembling so many distinct petals; and the leaves placed in whorls round the stalk at certain distances, in the form of a radiant star: from which last circumstance is derived the name *Stellatæ*, that is, star-like plants, by which the class under review is distinguished. Mr. Ray subdivides these plants, from the tube of the flower, which in some, as petty madder, is long; but in the greater part, very short. Of such as have a shorter tube, some produce their leaves by fours in the form of a cross; in others the leaves grow in greater number, and those either smooth, as in yellow ladies bed-straw and wild madder, the *galium mollugo* of Linnaeus; or rough, as in cleavers, and woodroof. Four naked seeds in the bottom of the flower-cup character-



characterize the two next classes, which stand thus distinguished. In the thirteenth the plants have rough leaves that are either placed alternately or without any order upon the stalk; and flowers of one petal, with the brims deeply cut into five segments. The flower-cup too is slightly divided into five; and, in some of the genera, the uppermost part of the spikes of flowers is twisted, before their expansion, into the form of a scorpion's tail. In the fourteenth class, the leaves are placed opposite by pairs; the flowers generally surround the stalk in whorls, and consist of one petal with two irregular lips, the uppermost of which, in the greater number of plants, resembles a helmet. The first mentioned class is exemplified in lungwort, comfrey, scorpion-grass and borragé; the other in sage, hyssop, betony, rosemary, and the other lip-flowers. Morison joined these two classes into one; Ray has with great propriety separated them. The fifteenth class contains plants in which each flower is succeeded by more than four naked seeds. Crow-foot, adonis, water-plantain, tormentil, cinquefoil and herb-bennet, furnish examples. In his History and Synopsis of British Plants, Mr. Ray refers to this class the mallow tribe, which, in his improved method, he has very judiciously transferred to the nineteenth.

SUCH are the distinctions of simple flowers arising from the number of naked seeds. In the eight following classes, the seeds are contained in a case or vessel, which is either pulpy or of a substance resembling parchment. The sixteenth class contains herbaceous plants which have a large succulent seed-vessel of the apple kind, covered with a thick rind or skin. The flowers are of one petal with five slight divisions, and stand upon the top of the fruit. Cucumber, gourd, melon, and balsam-apple, afford examples of the class in question. Passion-flower too is arranged by the author with the plants just mentioned, although it agrees  
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with them in nothing save the characteristic distinction of the class. The berry-bearing herbs which constitute the seventeenth class are distinguished from those having a pulpy fruit of the apple kind by the thin membranaceous skin that involves the pulp and seeds intermixed with it. Bryony, butcher's broom, nightshade, winter-cherry, capsicum, arum, asparagus, and herb-christopher, are referred with several others to this class. To each flower in plants of the eighteenth class succeed many distinct capsules or seed-vessels of a membranaceous substance. They are divided into two sections, from the consistence of the leaves, which in some is thick and succulent; in others, slender and dry. Navel-wort and house-leek pertain to the first section; pæony, hellebore, apocynum, swallow-wort, monks-hood, columbine and fraxinella to the second, which is subdivided from the regularity and irregularity of the flower. The plants with a single dry membranaceous seed-vessel are contained in the five succeeding classes, which stand distinguished from the number of petals of which the flower consists. In the nineteenth class, the plants have a single membranaceous fruit or seed-vessel with a divided or undivided cavity, and regular or irregular flowers of one petal. Tobacco, gentian, convolvulus, fox-glove, birthwort and toad-flax furnish examples. The twentieth class, which was instituted by Dillenius, contains capsular plants with two or three petals, and is exemplified in enchanter's night-shade, frog's-bit and water-soldier. Ray's twenty-first class corresponds to the sixth in Morison's method. In the plan under review, its characters are, flowers with four regular petals that are succeeded by seed-vessels of the *siliqua* or pod kind. The flower-cup too, in most of the species, falls off with the flower; the leaves are placed alternately upon the stem; there is a constant succession of heads of flowers on the summit of the branches; and the flower-stalks have no *stipulæ* or small auxiliary leaves stationed at  
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their origin. Rue, epilobium, poppy, and some other plants, are made very unsystematically to arrange themselves under the class in question. The leguminous plants, which constitute the twenty-second class, are characterized by Mr. Ray, after Tournefort, from the irregularity of their petals, which are generally four in number, and resemble a butter-fly with its wings expanded. The petals agree neither in figure, proportion, nor situation; the uppermost, generally larger and broader than the rest, is termed *the standard*; the lowermost, involving and defending the stamina and embryo seed-vessel, *the keel*; the two side petals which resemble each other in form, *the wings*. Leguminous plants are primarily subdivided by Mr. Ray from the leaves, which in some are *trifoliate*, that is, composed of three distinct lobes or lesser leaves connected on the top of a common footstalk; in others, *pinnated* or *winged*, that is, composed of more lesser leaves than three arranged on both sides of a common *costa* or middle rib; in some, finger-shaped; in others, simple. Of such as have not trifoliate leaves, the greater part bear pods containing a single row or series of seeds; in a few, as *astragalus* and *biserrula*, the pods are divided by a longitudinal partition into two cells, each containing its own proper series. Again, simple pods are either jointed, or not jointed. The former are composed of several knots resembling joints, in each of which is contained a single seed; the latter have an undivided cavity and no joints. French honey-suckle and horse-shoe vetch furnish examples of the jointed pod; lupine, pea and bean of that which has no joints. Of these last, some climb or are furnished with tendrils, as vetch, and everlasting pea; others want tendrils, and have their leaves either finger-shaped, as in lupine; pinnated or winged, as in saint foin and liquorice; or simple, as in crimson-grass vetch, the *lathyrus nissolia* of Linnæus. Leguminous plants with trifoliate leaves are subdivided into such as have a twining, and such as have an erect

erect stem. Kidney-bean is adduced as an example of the one; trefoil, melilot, rest-harrow and fenugreek of the other. The twenty-third class contains plants which have their seeds contained in a capsule or dry seed-vessel, and flowers composed of five petals. These are subdivided from the disposition of the leaves, which in some, as carnation, lychnis, and St. John's wort, stand opposite in pairs; in others, as purslane, saxifrage and winter-green, are placed alternately, or without any order upon the stalk. Dillenius instituted a new class, to be placed immediately after the twenty-third, consisting of capsule-bearing plants which have six or more petals. To this division are referred water-purslane, purple willow-herb and water-lilly.

THE first grand division of flower-bearing herbs being exhausted, we proceed to the second, which includes all herbaceous plants having one seed-lobe, or that rise with a single seed-leaf. This division contains but two classes, and is subdivided, like the former, from the presence and absence of the petals. The twenty-fourth class consists of plants which have a single seed-lobe or seminal leaf; flowers composed either of six petals, or of one deeply cut into six segments; and a capsule or dry seed-vessel divided internally into three cavities or cells. These are the liliaceous or bulbous-rooted plants, which, besides the characters just mentioned, have generally simple, grassy, sword-shaped leaves that are perfectly entire. In his original method, as likewise in his History of Plants, published in 1686, Mr. Ray distributed the plants in question into two classes, by the names of *bulbosæ*, and *bulbosæ affines*, that is, bulbous-rooted herbs, and such as bear an affinity to them. As some plants, however, which manifestly pertain to this class, would be excluded, by adopting the form of the root for the classical distinction, he has very properly rejected it in his improved method for that more systematical



tical character derived from the nature and internal divisions of the seed-vessel. Some species of *Iris* have a bulbous, some a tuberous, some a fibrous root. The genus certainly belongs to the class under review, yet could not have all its species referred to it, if the form of the root was made the classical distinction. Again, a species of *ranunculus* with a bulbous root, and some other herbs which manifestly belong to very different classes, would arrange themselves with the liliaceous plants, if, in discriminating this division of the method, the form of the seed-vessel had not been substituted for that of the root. Indeed, as the class now stands, there are some bulbous-rooted plants referred to it which have not the classical character, a capsule divided into three cells. Such are orchis, ladies slipper, bee-flower, and *limodorum*, whose seed-vessel or capsule has properly an undivided cavity. Mr. Ray, in his improved method, subdivides the liliaceous flowers into three sections. The first contains such as have a single petal divided at the brim into six segments, as hyacinth, asphodel, meadow-saffron, crocus, narcissus, iris and aloe: in the second are three distinct petals, of which flower-of-a-day, sometimes called Virginian Spider-wort, is the only example: and in the third are contained plants with six distinct petals, as lilly, tulip, star of Bethlehem, Guernsey-lilly, and crown-imperial. The twenty-fifth class contains the grasses, which, in the method under review, stand distinguished from the liliaceous plants, by the absence of the petals. Their other characters are, a cylindrical, jointed and generally hollow stalk; several slender, undivided, pointed leaves, which proceed singly from the joints, and are ranged alternately; and a single naked seed under each flower. This class is subdivided into such as bear larger seeds, as wheat, rye, oats, and the other kinds of corn, which furnish food to man; and into the grasses properly so called, which have a lesser grain, and are the principal nourishment of other animals. Rush, cypress-

press-grass, burr-reed, and a few other plants which have an affinity to the grasses, are referred to a separate section. The twenty-sixth class serves as an appendix to the first part of the method, and consists of such herbaceous plants as do not properly arrange themselves under any of the foregoing classes. This division was expunged by Dillenius, who has distributed all the British plants pertaining to it among those classes in the method to which they seemed to have the greatest affinity.

WE come now to subdivide trees and shrubs, which are primarily distinguished, like herbaceous plants, from the number of seed-lobes or feminal leaves. The curious tribe of palms are the only trees that have a single seed-lobe. These, therefore, singly constitute the twenty-seventh class, which, from the resemblance of the leaves of the plants in question to those of reeds, has obtained the name of *Arundinaceæ*. Of trees which rise with two feminal leaves, some have the flower placed at a distance from the fruit, either on the same or different plants, obtained from the same seed; whilst others have the flower and fruit placed contiguous. The twenty-eighth class consists entirely of trees of the former description. In these plants, the fruit is either hard, dry, scaly, and formed into a cone, as in fir, pine, cypress, and *arbor vitæ*; dry, but not scaly, nor cone-shaped, as in box; or of the nature of a berry or nut, as in juniper, yew, mulberry, walnut, hazel and oak. Trees which have the flower contiguous to the fruit, are arranged under the four following classes. These are primarily subdivided from the situation of the flower, which, in some, stands upon the top of the fruit, and, in others, surrounds it or coheres to its base. In such as have the flower seated upon the fruit, the calix is permanent, and, after the fall of the flower and consequent swelling of the seed-bud, forms in the fruit at the end opposite to the footstalk a cavity which, from its  
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resemblance to a navel, has obtained among botanists the name of *Umbilicus*. The plants of the twenty-ninth class have all an umbilicated fruit, and that either of the apple or berry kind; as pomegranate, pear, quince, medlar, rose, gooseberry, ivy, viburnum and elder. In the three following classes, the flower surrounds the fruit or coheres to its base, so that no *umbilicus* or cavity can be formed by the calix. The thirtieth class contains trees which, besides the common character just mentioned, have always a pulpy fruit, either of the cherry, berry or apple kind. It is exemplified in plumb, almond, apricot, peach, mistletoe, mock-privet, jessamy, arbutus, orange, custard-apple and calabash. In the thirty-first class, the seed-vessel is dry, but not of the pod kind. In the thirty-second, the plants are leguminous, that is, bear pods, and have generally a papilionaceous or butterfly-shaped flower. Elm, maple, ash, lime and mock orange, arrange themselves under the former; tamarind, acacia, broom and coronilla with many others, under the latter. There remains only one class, the thirty-third, which serves, in some sort, as an appendix to this part of the method, as the twenty-sixth does to the division of herbaceous plants. It contains only one genus, the fig, which differs from all other trees in having the flower concealed within the fruit.

THUS have I, with considerable labour, toiled through the numerous classes of this complex and highly intricate method of arrangement. Were I to pronounce with impartiality of its merits and defects, I should not scruple to assert, that, however beautiful in the idea, neither the plan nor execution is, in any degree, calculated to facilitate the knowledge of plants. In fact, it seems to have been Ray's great object, no less than that of Morison, to collect as many natural classes as possible; and these being separately investigated, a multiplicity of characters and steps  
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was necessarily required to connect them. Hence the intricacy complained of, which must always exist, where the classes give rise to the connecting characters, not the characters to the classes. Eminent as is the rank of this author in the list of botanical writers, several instances could be adduced in which the execution is inferior even to the plan, and vegetables are erroneously referred to particular branches of the method. In anatomizing the classes, I had occasion to mention some improprieties of this kind. The following, not hitherto recorded, deserve attention. Agrimony has two naked seeds that are lodged in the bottom of the calix, yet is referred by Ray to the tenth class, which, as the reader will observe, contains plants whose flowers are succeeded by a single naked seed. To the same class are referred fumatory and meadow-rue; although the former is furnished with a seed-vessel, and the latter has many naked seeds instead of one. The distinction from the number of seed-leaves, however proper in detecting the order of nature, or connecting assemblages that have been already detected, is of all others the most unsatisfactory in conducting to the knowledge of plants. An herbaceous vegetable is presented to me which I am to investigate by the method just illustrated. My first enquiry is, whether the plant rises with one or two seed-leaves? The question appears simple and easy; and yet it is a thousand to one that I am incapacitated by circumstances from returning a proper answer. For, if the plant has passed, though never so little, its first stage of vegetation, so that the expansions of the lobes of the seed are no longer visible, in vain do I look for a solution of my query, till its ripened seeds have, in germinating, protruded one or two seminal leaves similar to those exhibited by itself in the infancy of its progress. Thus the presence of both flower and fruit is, in the first instance, of no avail; and the number of seed-leaves must absolutely be recognized, before the plant can be referred to its primary division  
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in the method : I say, its primary division, because many subordinate characters pass under review previous to the determination of its class. The number of seed-leaves constitutes the first division ; the presence or absence of the petals, the second ; the simplicity or composition of the flowers, the third ; the presence or absence of a vessel for containing the seeds, the fourth ; the number of naked seeds, the fifth ; the nature of the seed-vessel, the sixth ; the number of petals, the seventh. Encumbered with such a multiplicity of characters, many of them not accurately determined, how is it possible that the method should be useful ? As an attempt to investigate the order of nature, its merit is great and conspicuous. The first, third, fourth, sixth, eleventh, twelfth, thirteenth, fourteenth, sixteenth, twenty-first, twenty-second, and twenty-fifth classes, are true natural assemblages. In fine, to such as are already masters of the science of plants, no plan of arrangement affords equal pleasure with that of Ray. The order of nature, where it could be traced, is carefully pointed out ; and the affinities of plants delineated with a masterly hand. To beauties of this kind the novice in Botany is insensible ; he requires an easy method of investigating plants, and, provided he obtains it, is totally indifferent whether the classes are natural or artificial.

THE characters of the orders or secondary divisions in Ray's method are no less multifarious than those of the classes. They respect the place of growth of plants, their qualities, the figure of the stem, the number, situation, substance and division of the leaves, the situation and disposition of the flowers and calix, the number and regularity of the petals, the number and figure of the fruit. In his improved method, Ray has adopted Tournefort's characters of the genera, wherever his plan would permit. His General History of Plants contains descriptions of 18655 species and

and varieties. The third volume, which was not published till 1704, and is designed as a supplement to the two preceding ones, contains the plants discovered by Tournefort in the Levant, and by Camelli at Luzon, one of the Philippine Islands. Ray's method was followed by Sir Hans Sloane in his Natural History of Jamaica; by Petiver in his British Herbal; by Dillenius in his Synopsis of British Plants; and by Martyn in his Catalogue of Plants that grow in the neighbourhood of Cambridge.

To Ray's original method succeeded that of Christopher Knaut, a German, which acknowledges the same principle, and is manifestly founded upon it. In his Enumeration of the plants that grow naturally around Hal in Saxony, published at Leipzig in 1687, the few vegetables he describes are arranged into seventeen classes which have for their basis, the size and duration of plants, the presence or absence of the petals, the disposition of the flowers, the substance of the fruit, the number of capsules or seeds, the number and figure of the petals, and the presence, absence or figure of the calix. After the usual distribution of vegetables into herbs and trees, Knaut proceeds to discriminate the former, from the presence and absence of the petals. Herbs that are furnished with petals he again subdivides into such as bear simple, and such as bear compound flowers. The former arrange themselves into nine classes, which stand distinguished by the presence or absence of a vessel for containing the seeds. In plants of the first class, the seeds are inclosed in a fleshy succulent vessel of the berry kind, of which arum, bryony and night-shade afford proper examples; in the seven classes which immediately succeed, the case or vessel is dry and membranaceous. The second class contains plants with a single capsule or dry seed-vessel, and one petal; and is exemplified in fumitory, gentian, fox-glove, convolvulus and birthwort. Four regular petals characterize the third class, as do four

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irregular petals the fourth, which correspond to the twenty-first and twenty-second classes of Ray. The fifth, sixth and seventh classes contain plants with five, six and many petals, and answer to the twenty-third and twenty-fourth classes of the same author. Plants with more than a single capsule constitute the eighth class, which is exemplified in swallow-wort, columbine, aconite, pæony and hellebore, and corresponds to the eighteenth class of Ray. All plants having naked seeds or wanting a seed-vessel are contained in Knaut's ninth class, which consequently includes the umbelliferous and rough-leaved plants, those with leaves disposed in the form of a radiant star, the lip-flowers and several others. The compound flowers, which constitute the two next classes are distinguished from the presence or absence of the *pappus* or downy crown of the seed. In the tenth class, which is exemplified in daisy, feverfew, tanfy, scabious, teasel and eryngo, the seeds are solid, that is, want the crown alluded to; in the eleventh, of which after, golden-rod, groundsel, thistle, dandelion and nipple-wort furnish examples, they are crowned with a *pappus* or downy calix. The preceding classes exhaust the distribution of herbaceous plants that are furnished with petals. In the four following classes, which conclude the first division of the method, the petals are wanting; and that either solely, as in the twelfth and thirteenth, which are exemplified in hop, nettle, mercury, dock and the grasses; or in conjunction with the calix, as in the fourteenth and fifteenth, which correspond to the four first classes in Ray's method; the former containing the ferns; the latter, the mosses, mushrooms and sea-weed. It remains only to be observed that woody vegetables, which constitute the second grand division, are very unsystematically huddled together, as in Ray's original method, into two classes, the one including trees, the other shrubs:

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SUCH is the general method of Christopher Knaut, which Linnæus very properly terms Ray's original System inverted. Trees are placed after herbaceous vegetables, petal-wanting herbs after such as are furnished with petals, plants with naked seeds after such as have the seeds contained in a case or vessel, plants with many dry membranaceous seed-vessels after such as are only furnished with one, and compound flowers after those which are simple. The distinction from the lobes of the seed Knaut has entirely rejected; as he has likewise that of flower-bearing and flower-wanting herbs. On the whole, however, his method is not a whit easier or more practicable than that of Ray: the uncertain distinction of petal-bearing and petal-wanting flowers is still retained; a multiplicity of steps is employed in connecting the classes; and if the author has diminished the number of these, by thrusting several into the place of one, he has likewise rendered them doubly intricate, by making a variety of subdivisions necessary. Plants which bear naked seeds occupy six classes in Ray's improved method: in the method under review they are all referred to one. Much, it may be thought, is gained here in point of facility. A plant with one, two, four or many naked seeds is referred at sight to the ninth class in Knaut's method. But although its place in the arrangement is so quickly determined, I am not a whit nearer in investigating the plant. For, upon examination, I find, that the sections or subdivisions of the class in question exactly correspond to the classes containing plants with naked seeds in Ray's method: so that 'tis only substituting the term *division* for *class*, and *class* for *section* or *sub-division*, and the two methods are, in this respect, exactly the same. Thus Knaut, by abridging Ray's method, has neither removed its difficulties, nor rendered it less impracticable. The faults of his arrangement, however, are not merely negative. He has entirely effaced the beauty of his original, and destroyed its



symmetry. The natural classes, which constitute the chief, perhaps the sole merit of Ray's system, find no place in that of Knaut; and in their stead we are presented with classes, which do not compensate for the want of numerous relations, by possessing any superior facility in conducting to the knowledge of plants. There is no certain mark of distinction betwixt the twelfth and thirteenth classes, which contain herbaceous plants that want petals, but have the flower-cup. The fourteenth and fifteenth, which include all the flower-wanting herbs of Ray, are not more accurately distinguished. In fine, the copy is greatly inferior to the original, and, indeed, possesses no great share of merit, either in point of execution or utility.

THE sections or subdivisions of the classes in Knaut's method are sixty-two in number, and arise from the figure of the stem and petals, the number of capsules and cells, their figure, the number of seeds and leaves, and situation of the flowers.

DOCTOR Herman's method, which comes now to be analysed, is formed, partly on that of Morison, partly on that of Ray, and affords as beautiful distinctions as any mode of distribution hitherto invented. Its author, professor of Botany at Leyden, was the first who introduced into Holland a genuine systematic arrangement of plants from the parts of fructification. Morison's method had been left incomplete; and Ray's, though perfect from its first appearance, did not all at once attract the attention of the learned, and was indeed for many years studied chiefly in England, the native country of its author. The defects of Ray's original method, and its impracticability, did not elude the observation of Herman. He had applied himself with unremitting ardour from his earliest years to the study of plants, had examined with attention every plan of arrangement, and actually under-  
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taken a long and perilous expedition into India, with the sole view of promoting his favourite science. Such a man merited the applause of the public, and he obtained it. He was recalled from his expedition, and appointed to superintend the botanical school and garden at Leyden : in the discharge of which important office, he exhibited such marks of unwearied diligence, that twice as many plants are said to have been reared by Herman alone, as had been introduced into the garden by all his predecessors put together, Bontius, Clutius, Pavius, Clusius, Vorstius, Schuylius, and Syenus, in the long space of a hundred and fifty years. Boerhaave relates, that, in 1681, the number of plants in the garden at Leyden amounted to only one thousand five hundred and thirty-seven ; and that eight years after they had increased, by the industry of Herman, to the amazing number of three thousand and upwards.

THE method proposed by Herman was first published to the world in 1696, by Zumbac, who arranged according to it the plants demonstrated by its celebrated author in the public garden. Rudbeckius the younger, in a Dissertation published the same year on the fundamental knowledge of plants, has adopted Herman's method with a few inconsiderable variations. Lastly, in 1695, Herman himself, fully convinced of the necessity of emendations in the primary as well as subaltern divisions, set about an accurate edition of his method, in which he had made a very considerable progress, when death put a final period both to him and his work.

HERMAN'S method consists of twenty-five classes, which are founded upon the size and duration of plants, the presence or absence of the petals and calix, the number of capsules, cells and naked seeds, the substance of the leaves and fruit, the form and

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consistence of the roots, the situation and disposition of the flowers, leaves and calix, and figure of the fruit. After distributing all vegetables into herbs and trees, the author proceeds with Knaut to arrange the former into two divisions, from the presence or absence of the petals. Petal-bearing herbs constitute the first division, and are contained in eighteen classes, which stand distinguished by the absence or presence of a vessel for containing the seeds. The first seven classes exhaust the division of herbaceous plants with naked seeds. In the first are contained plants whose flowers are succeeded by several naked seeds that are joined together and form a head. It corresponds to the fifteenth class in Ray, and is exemplified in ranunculus and meadow-rue. The umbelliferous plants constitute the second class, the characteristics of which are, two naked seeds, and flowers of five petals formed into an umbel. The third and fourth classes agree in having a single naked seed, but differ in the nature of the flowers, which are simple in the former, compound in the latter. This distinction has been fully explained already. The fifth class, which should have immediately succeeded the second, contains plants that have two naked seeds, and flowers with one petal. These are the *stellatæ* or *star-like* plants of Ray. Four naked seeds characterize the two next classes, which contain the rough-leaved plants and such as flower at the joints, of the same author. Of plants which have their seeds contained in a vessel, some bear a membranaceous, some a pulpy succulent fruit. Membranaceous seed-vessels are either of the capsule or pod kind. Plants with a single capsule are divided from the form of the roots, which, in some, are bulbous, in others, not bulbous. Those which arrange themselves under the latter division are again subdivided from the number of cells, caverns or internal cavities of the seed-vessel. In the eighth class, the fruit has one cell, in other words, an undivided cavity; in the ninth, there are two cells, in the tenth three,



three, in the eleventh four, in the twelfth, five or more. The bulbous-rooted plants, which constitute the twenty-fourth class in Ray's method, are very improperly disjoined by Herman from the division to which they belong, and transferred to the sixteenth class, where they are perfectly solitary, and maintain no sort of connection with any of the plants in their neighbourhood. Herbs with many capsules are all contained in the thirteenth class which corresponds to the eighteenth in Ray. The fourteenth and fifteenth classes contain plants with a dry membranaceous seed-vessel of the pod kind; the former includes the cross-shaped, the latter the butter-fly-shaped or pea-bloom flowers of later botanists. Herbs with a pulpy fruit form the seventeenth and eighteenth classes, which stand distinguished, as in Ray, from the covering of the pulp, which, in the former, is thin and slender, in the latter, coarse and thick.

SUCH are the distinctions of petal-bearing herbs adopted by Herman. Herbs which want petals are contained in the three following classes, and arrange themselves, as in Knaut, from the absence of that organ alone, or of both calix and petals. The nineteenth class consists of herbaceous plants which want the petals, but are furnished with a flower-cup properly so called. It is exemplified in rhubarb, dock, spinach, and plantain. In the twentieth class, which contains the ferns, and some herbaceous plants, whose flowers grow in catkins, both calix and petals are wanting. The twenty-first includes the grasses, and such plants as have an affinity to them. They are distinguished from those of the two preceding classes, by the presence of a *gluma* or husky calix. In Knaut's method, the grasses are very improperly thrust into a class with plants to which they have no affinity: so that an accurate characteristical mark cannot be assigned for discriminating the two classes of plants that want the petals. In the  
method



method under review, the grasses being assigned a separate class, are accurately distinguished from all other plants that want petals, by the nature of their flower-cup, which is of that kind termed a *gluma* or husk; whilst the presence of a cup, without respect to its nature, serves effectually to distinguish them from the ferns, mosses, and such other plants as have neither calix nor petals.

IN subdividing trees and shrubs, Herman has greatly improved upon Ray. The twenty-second class consists of trees whose flowers want petals and grow in catkins. It corresponds to the twenty-eighth class in Ray's method, the plants of which, as the reader will remember, have the flower placed at a distance from the fruit. To this class Herman has referred the tribe of palms, which occupy a whole division in Ray. Trees with a pulpy umbilicated fruit constitute the twenty-third class, under which is arranged the fig, by Ray placed in the appendix to his method, from its singularity in concealing the flowers within the fruit. The twenty-fourth class consists of trees with pulpy fruits which are supported, not crowned by the calix: the twenty-fifth of such as have a dry membranaceous seed-vessel. The former corresponds to the thirtieth; the latter to the thirty-first and thirty-second classes in Ray's method, which improperly disjoined trees with dry seed-vessels of the pod kind from such as have a dry membranaceous fruit of another form.

By attending to the analysis just given, the reader cannot fail to observe, that the method proposed by Herman excels all which preceded it, in the uniformity of its classical characters. The author set out with the fruit for his principle, and has adhered more closely to it than either Morison, Ray or Knaut. In the first eighteen classes, the number of naked seeds, the nature of the different seed-vessels, and the number of cells or internal  
cavities

cavities of the fruit furnish the sole distinction. No such uniformity characterizes the methods of the systematical writers just mentioned. Ray and Knaut have subdivided that branch of their respective methods which contains plants having a dry membranaceous seed-vessel, from the number of petals; Herman from the number of cells or cavities of the fruit. The transition from the seed-vessel to the petals is unnatural, because the latter precede the former: the transition from the seed-vessel to its internal divisions is in the true spirit of systematic arrangement, which, attaching itself to one particular part, is studious to exhibit it, for the purpose of discriminating bodies, under every possible point of view. Herman's superiority in this respect is indisputable. Even the distinction of simple and compound flowers he has rendered subordinate to the principle with which his method sets out, and, instead of employing it, as Ray and Knaut have done, in discriminating all flower-bearing plants that are furnished with petals, has restricted it to the distinguishing of two classes, those, to wit, containing plants whose flowers are succeeded by a single naked seed. But though, by this improvement, Herman has rendered his method more uniform, he has added nothing to its facility. In fact, the number of naked seeds is a very equivocal character when employed in distinguishing compound flowers, which we may as properly arrange with Cæsalpinus among plants that bear many naked seeds, as with Herman among such as bear but one; the former respecting the aggregate, the latter, each particular floret of which it is composed.

THE distinction of naked and covered seeds makes a very principal figure in all the methods founded upon the fruit, particularly in those of Ray, Knaut, and Herman. Yet, strange as it may seem, there is no characteristical mark that, in all cases, shall, with accuracy, distinguish the one from the other. Whatever,



when ripe, detaches itself from the mother-plant spontaneously and singly, is denominated by Mr. Ray a naked seed. He adds that, in dubious cases, we are always to be determined by the structure of the plants of the same natural class. Thus, continues my author, in leguminous plants with a single seed, and some others that bear small pods of the *siliqua* kind, the fruit falls off from the parent-plant without splitting, and dispersing the inclosed seeds. Yet is not the whole substance so detached to be deemed a naked seed; why? because most of the plants which have nearest affinity to those in question are confessedly furnished with a seed-vessel that is either replete with numerous seeds, or, if it contains but one, is found to open spontaneously, when ripe, with a view to expel it. The truth of this conclusion I allow, but deny its utility. A novice in Botany, and it is to such an one that every plan of arrangement ought to accommodate itself, will be little benefited by the distinction just mentioned. His object is to investigate plants by a method of arrangement, the principles of which he comprehends. He understands the terms *naked* and *covered* seeds, in the general sense expressed in their definition; he expects that the meaning of words should never be violated; that they should, at first, be defined with a logical exactness, nor be ever made to convey any other sense than that with which they were originally impressed. He is supposed to be totally ignorant, not of the plant in question only, but of all such as bear affinity to it: how then, in doubtful cases, shall Mr. Ray's rule be applied? He is to be determined by the plants of the same natural class; but those plants are unknown to him: he must depend then entirely upon the rectitude of the definition, which, as we have seen, is evidently calculated to bewilder and mislead. I decline stretching this criticism to its utmost extent, and shall only observe that, as no characteristical mark has hitherto been ascertained, which, in all cases, shall discriminate *naked* from *covered*

*covered* seeds, the distinction, far from having infallibility ascribed to it, ought, in my opinion, to be employed with no less reserve than that derived from the presence or absence of the petals. An ingenious botanist of the present century, whose tenets I shall have occasion in the sequel to discuss, has not scrupled to deny the existence of naked seeds, and of consequence, the reality of the distinction before us. I will not at present enter largely into the merits of this paradoxical dogma, which I am clearly of opinion owed its origin to mistaken notions of the analogy that subsists between plants and animals. Seed-vessels or receptacles of the seeds are in the vegetable kingdom what the *uterus* of viviparous animals, is in the animal. The seeds contained in the case or vessel correspond to the fœtus inclosed in the *uterus*. Perhaps, the author just alluded to, may have extended the analogy to oviparous animals, and even to such in which the process of generation is less accurately discerned. His mode of reasoning then has probably been as follows: seed-vessels are confessedly analogous to the *uterus* of animals; now all animals are furnished with an *uterus*, or some organ which performs its functions; therefore all plants are furnished with a seed-vessel for inclosing and nourishing the vegetable fœtus. This proposition, however, is not logically true, because neither the major nor minor have been demonstrated such. Indeed, if the analogy contended for could be fully proved, and all animals demonstrated to be furnished with an *uterus*, I should think the consequence infallibly certain: but as neither of these has been attempted, and both major and minor are entirely hypothetical, the syllogism is false, and the conclusion or inference erroneous. That the analogy does not hold good in every case, is indisputable. I shall allow that the seed-vessels of plants which gape and expel the seeds, may be thought analogous to the *uterus* of viviparous animals: and the seeds so expelled with their proper teguments to the



animal fœtus that is protruded with its coverings. But is this analogy universal? Do the seed-vessels of all plants split when ripe, for the purpose of expelling their seeds? The contrary is indubitable. Pulpy fruits of the apple, berry and cherry kind neither split when ripe, nor adhere to the plant, as the uterus always does to the animal, but detach themselves from it with the inclosed seeds. Again, seed-vessels which split when ripe, and adhere to the plant after the dispersion of their seeds, cease to be useful in vegetation. They are temporary parts destined to inclose and expel the seeds. Their nature admits not of a second fecundation; they have been once fruitful; they have expelled their seeds; the end of their destination is accomplished; they wither, moulder and rot. How striking the disparity in animals! The female *uterus* is no temporary part, nor limited to a single fecundation. It is coeval, subsists and dies, with the animal; and is destined to perform, not once, but frequently, its valuable functions of inclosing and nourishing the tender fœtus.

FROM this digression, which the main subject afforded me, I return to mention some improprieties committed by Herman in the execution of his plan. The first seven classes contain plants with one or more naked seeds: but instead of beginning with the most simple, and proceeding to the more complex, Herman scarce observes any order in their arrangement, save that suggested by the conveniency of demonstration. Plants with many naked seeds occupy the first class, because they produce their flowers very early in the spring. Next come the umbelliferous plants, which bear two naked seeds; then the simple and compound flowers with one; to these succeed the plants with leaves disposed like a radiant star, which, like the umbelliferous plants, bear two; and lastly, the rough-leaved plants and such as flower at the joints, whose characteristic is four naked seeds. Rudbeckius,

beckius, in his edition of Herman's method, has removed the impropriety complained of, by beginning with the most simple classes, those, to wit, whose plants bear a single naked seed, and proceeding by degrees to such as are more complex, that is, have plants with two, four or many seeds. With the plants of the first class, Herman, after Ray, has improperly arranged those of the mallow tribe, which producing, not a number of naked seeds, but a capsular fruit divided into several cells, ought unquestionably to be referred to the twelfth class, with the characteristics of which the plants in question agree. Scarce any of the plants of the third class, which corresponds to the tenth of Ray, are found to possess the classical character, a single naked seed. In all the species of valerian, the flower is succeeded by a streaked capsule, which in some is less conspicuous, in others, thick and hard as a crust; and, in a particular species, furnished with two cells, one of which is generally empty. Marvel of Peru has its single seed covered with a husk or outer coat, which may be easily stripped off, if not over-dried. Enchanter's night-shade is furnished with a capsule that has two cells, each containing a single seed. Fumatory has a small undivided pod of the *siliqua* kind; agrimony two naked seeds lodged in the bottom of the calix. Some of the other classes with naked seeds are liable to exceptions of the like kind. What Herman and Ray denominate two naked seeds in the plants whose leaves are disposed in the form of a star, Linnæus, with much greater propriety, terms a twin-berry of a dry substance, inclosing two seeds. Loose-strife has a capsular fruit with an undivided cavity, and therefore ought not to be arranged with the plants of the ninth class, the characteristic of which is a capsule with two internal divisions or cells. Gentian, lesser centaury and saxifrage, are to be excluded for the same reason. Some species of hypericum have one, some two, some five cells; yet are they all placed without distinction in  
Herman's



Herman's tenth class, which includes such capsular fruits as are divided internally into three cavities or cells. To the same class are improperly referred the violet, cardinal flower, and sheep-scabious, the first of which has an undivided cavity, the others, a capsule with two cells. Grass of Parnassus has one cell, winter-green five, and asarabacca six. In fact, except greek valerian, rampions, and bind-weed, there are none of the plants in the tenth class that agree in the general character; nor those always neither; the fruit of bind-weed being sometimes entire or undivided within. Thorn-apple and rue are referred to the eleventh class, which contains capsular fruits with four cells, altho' the former has always two, and the latter, except in one species, always five cells. Poppy and prickly poppy have an undivided cavity, and therefore do not pertain to the twelfth class, the fruits of which are divided into five or more cells. Many more improprieties of a similar nature might be mentioned; but I forbear entering farther into the merits of the method before us, because the instances already given are sufficient to evince, that the execution is greatly inferior to the plan.

THE classes in Herman's method are subdivided into eighty-two sections or orders, which have for their basis the number of petals, seeds, capsules and cells, the figure of the seeds and petals, and disposition of the flowers. The second, fifth, sixth and seventh classes are true natural families.

OUR review of methods founded on the fruit closes with that of the celebrated Dr. Herman Boerhaave, who, succeeding to the botanical chair at Leyden in 1709, spared no endeavours to preserve among his countrymen that love for the science of plants which his predecessor, Herman, had happily introduced. His method is that of Herman, combined with part of the methods  
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of Tournefort and Ray. The submarine and imperfect plants, which find no place in the system of Herman, are borrowed by Boerhaave from that of Ray. To collect as many natural classes as possible, he has likewise adopted the distinction first suggested by the same author from the number of seed-lobes or seminal leaves. The compound flowers form four classes, which derive their characters partly from Ray, partly from Tournefort. Lastly, trees are distributed, as in the latter writer, from the flower, not as in Ray and Herman, from the fruit. It deserves to be remarked, that Boerhaave, to avoid confusion, has classed all trees and shrubs which bear butter-fly-shaped flowers with such herbaceous plants as have flowers of the same figure. Tournefort, by retaining the ancient distinction into herbs and trees, and characterising both by the figure of the petals, has been led to institute several classes which, agreeing with others both in the general character and title, ought to be excluded as superfluous. In Boerhaave's method, which is founded partly on the fruit, partly on the flower, an agreement of characters in different classes was less to be apprehended. The pea-bloom flowers, in fact, appeared to the author the only plants from whose separation could arise classes with similar characters. He has therefore preserved the family entire, and arranged the papilionaceous trees with the papilionaceous herbs. For my own part, I cannot approve of this junction, as I profess myself insensible of the danger which the ingenious author was so studious to avoid. Herbaceous plants with a pea-bloom flower are arranged by Boerhaave after Herman and Ray, not from the figure of the flower, but from the nature of the fruit, which is that kind of pod termed a *legumen*. Trees then with pea-bloom flowers might have formed another class, the characteristic of which being the figure of the flower, and not the substance or figure of the fruit, rendered it impossible to confound the plants in question with those of the herbaceous kind



kind just mentioned. Upon the whole, Boerhaave ought either to have rejected the distinction into herbs and trees altogether, or to have retained it entire. By placing leguminous trees in the same class with leguminous herbs, he has discovered a want of attention to the main purpose of systematic arrangement, and precipitately encountered a real danger, in order to avoid an imaginary inconvenience.

BOERHAAVE's classes are thirty-four in number, and subdivide themselves into a hundred and four sections, which have for their characters, the figure of the leaves, stem, calix, petals and seeds; the number of petals, seeds and capsules; the substance of the leaves; the situation of the flowers and their difference in point of sex. By this method Boerhaave arranged near six thousand plants, the produce of the botanical garden at Leyden, which he carefully superintended for the space of twenty years, and left to his successor, Dr. Adrien Royen, in a much more flourishing state than he had himself received it. His Index or Catalogue of the Leyden plants was published in octavo in 1710, and afterwards, with great additions, in quarto in 1720. This last edition contains descriptions of five thousand, six hundred and fifty plants, of which number upwards of two thirds had been introduced into the garden since the time of Herman, by the industry of his illustrious successor. Boerhaave's characters are derived from the habit or general appearance of plants combined with all the parts of fructification; so that, as Linnæus very properly observes, he was the first who employed the calix, stamina and style in determining the genus. About seventeen new genera were established by this author; among others, the very splendid family of the *protea* and silver-tree, which, although partly described by Morison, had remained generally unknown till the period now under review. His method was adopted by one  
Ernsting,

Ernsting, a German, in a treatise entitled, *The first Principles of Botany*, published in octavo, at Wolfenbuttel, in 1748. To detect the order of nature, not to discover an easy plan of arrangement, seems to have been the darling object of Boerhaave; in attaining which, however, he has been so little successful, that, of the four-and-thirty classes which compose his difficult and complicated method, no more than eight can be reckoned true natural assemblages. These are the classes containing the ferns; the umbelliferous and rough-leaved plants; those which flower at the joints and have leaves disposed at proper intervals round the stem in form of a radiant star; the cross-shaped and pea-bloom flowers; and the division of compound flowers with flat petals, and a lactescent or milky stalk. The other classes are purely artificial, and contain plants which, not possessing numerous relations, are approximated only by their agreement in the single mark that characterizes the class.

THE inconveniencies which attend every mode of arrangement founded upon the fruit have already been mentioned: and if the reader has carefully perused the preceding part of this section, he will not only readily acknowledge their existence, but be apt to wonder that with imperfections, such as those I have recorded, a series of methods should have continued in estimation so long. In fact, to the writers, whose works we have been examining, the novice in Botany is little obliged. Solicitous to collect the affinities of plants, to investigate the order of nature, and discriminate her numerous assemblages, they forgot that the main purpose of system is to facilitate to others the knowledge of the objects about which it is conversant. To masters of the science their researches afford the highest intellectual entertainment: whilst to the beginning botanist they are equally sparing of information and delight. The rage which so long subsisted



for discovering the philosopher's stone proved beneficial to chemistry, by casually enriching it with several valuable discoveries; the passion for investigating a natural method in Botany was productive of a quite contrary effect, and had well nigh annihilated the science which it was meant to aggrandize and improve. Blinded by the prevailing prejudice, each succeeding writer adopted the errors of his predecessor; and no one could be found possessed of sufficient courage to venture upon an unbeaten path, even if genius had administered the proper assistance in pointing it out. Each walked in the track marked out for him by another. Morison followed Cæsalpinus; Ray improved upon Morison; Knaut abridged Ray; Herman formed himself partly on Morison, partly on Ray; Boerhaave makes Herman his guide, and calls in Ray and Tournefort as auxiliaries. Augustus Quirinus Rivinus, a German, Professor of Botany at Leipzig, was the first who, in 1690, relinquishing the pursuit of affinities, and convinced of the insufficiency of the fruit, set about a method which should atone, by its facility, for the want of numerous relations, and natural families. A method purely artificial appeared to Rivinus the best adapted for the purpose of vegetable arrangement. He saw in all their magnitude the imperfections of those methods which, setting out with the professed design of detecting the order of nature, had accomplished but half their aim. He resolved to profit by the errors of his predecessors, not blindly to adopt them; and rejecting the fruit which had proved an insufficient principle, and the source of numberless imperfections, he attached himself to the flower, which he was sensible furnished characters no less numerous, permanent and conspicuous than those of the fruit. In the methods that have been already analysed, the reader will have observed that the seed-vessel and seeds, the two constituent parts of the fruit, were employed in conjunction. Perhaps either does not furnish sufficient variety of characters to  
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serve singly as the foundation of a method. Be that as it may, the parts of the flower lie under no imputation of this kind. The calix, petals, stamina and style or pointal, which constitute the flower, are each sufficiently diversified in point of number, figure, proportion and situation to serve as the basis of a mode of arrangement; yet all are not equally proper for that purpose. Rivinus made choice of the petals as the largest and most beautiful part, and that from which the flower itself is vulgarly characterized. His method consists of eighteen classes, which have for their basis the perfection and disposition of the flowers, and regularity and number of the petals.

As Rivinus set out with the professed design of imparting facility to Botany, he judged very properly in divesting his method of all extraneous matter, and rendering it as simple and uniform as the nature of the science would admit. The distinction into herbs and trees had been adopted by every writer on plants since the time of Aristotle. Rendered, in some measure, sacred, by its antiquity, it long maintained a consequence which had better befitted characters less insufficient, and more clearly ascertained. Rivinus was the first who in this matter dared to think for himself; he was early sensible of the inconveniencies to which those had submitted who employed it as a primary division; he resolved therefore at once to get rid of a distinction that is frequently uncertain, always destructive of uniformity, and in its nature repugnant to the genuine spirit of system, because totally unconnected with the parts of fructification. His reasons for this laudable, but unprecedented step, he has delivered with great precision in a letter addressed to Mr. Ray, soon after the publication of his method, in which likewise the propriety of the aforesaid distinction is fully handled.



THE method now before us opens with a division from the presence of the petals and calix, and absence of either or both. Flowers that are furnished with both the organs in question, are said, in the language of Rivinus, to be perfect or compleat; those which want either or both are denominated imperfect or incompleat. This distinction was formerly hinted at, and its superiority above that derived from the presence or absence of the petals alone fully proved. Perfect flowers, which occupy the first seventeen classes, are subdivided into a double phalanx, the one containing simple, the other compound flowers. It would be unnecessary to enlarge upon this distinction, as the reader who has perused Ray's method with attention, will be at no loss for its discriminating character. Simple flowers subdivide themselves into such as are regular, and such as are irregular. Regular flowers are defined by Juniger, Ray and Christian Knaut, to be such whose petals agree, not so much in magnitude, as in figure and situation. Rivinus's idea is different. The petals, or divisions of the petal, if there is but one, must correspond not in figure and situation only, but also in size; in one word, they must be every way equal. Nor is this all. Other characters are required to be present, in order to constitute the flower strictly regular. The style is to issue from the center of the flower; the calix to have its divisions equal, and the stamina to be proportionable in number to the petals or their divisions. This first part of the method then forms two branches, which are each subdivided from the number of petals into seven classes that have the same characters and title, and differ only in the equality or inequality of the flowers. We begin with the regular flowers, which occupy the first seven classes. Plants of the first class have regular flowers of one petal. It is exemplified in marvel of Peru, madder, borrague, hound's-tongue, mallow, hyacinth, water-leaf and swallow-wort. The second class contains only one genus, enchanter's night-shade, which bears regular

gular flowers with two petals. Flowering-rush, frog's-bit and water-plantain, afford examples of the third class, whose characteristic is three regular petals. The fourth and fifth classes are numerous, and contain plants with four and five regular petals. Poppy, barren-wort and the cross-shaped flowers arrange themselves under the former; saxifrage, ranunculus, myrtle, columbine, with several others under the latter. The sixth class consists of flowers with six regular petals, and is exemplified in most of the liliaceous or bulbous-rooted plants. More petals than six, and a regular flower characterize the seventh class, of which adonis, anemone and ficoides afford proper examples. The irregular flowers with one petal are exemplified in sage, rosemary and the other lip-flowers. Those with four petals are the papilionaceous or pea-bloom flowers of later botanists. The umbelliferous plants with some others, particularly aconite, lark-spur, violet and fraxinella occupy the class containing flowers with five irregular petals. Irregular flowers with six petals are exemplified in orchis, ladies-slipper and honey-flower. The classes destined for containing plants with irregular flowers of three and many petals, were inserted in order to render the plan of arrangement complete: for neither Rivinus, nor Heucher, who published the greatest part of his method, were acquainted with any plants that could arrange themselves under either of these classes. Two genera only pertain to the class of irregular flowers with two petals. The compound flowers are very improperly interjected by Rivinus betwixt the regular and irregular simple flowers, and occupy three classes, which stand distinguished from the regularity and irregularity of the florets of which the aggregate is composed. In the first class, which is the eighth of the method, the florets are all regular and equal. Globe-thistle, globe-amaranth, centaury, burdock, eryngo and water-lilly are adduced as examples. This class corresponds to part of the *capitatae* of Ray,  
and



and to the compound flowers with hollow florets of Tournefort. The second class is composed of florets that are partly regular partly irregular, and is exemplified in sun-flower, daisy, and the other radiated flowers of the French botanist, which have hollow regular florets in the center or disk, and flat irregular ones in the circumference, margin or ray. In the third class, the florets are all of an irregular figure, being hollow at the base, and flat above. The plants which compose it correspond to the compound flowers with flat petals and a milky stalk of Ray, and to those with semi-florets of Tournefort. There remains but one class, the eighteenth, containing all the plants by Rivinus termed imperfect, that is, which have none or only one of the covers present. These are the cone-bearing plants, those whose flowers grow in catkins, the grasses, the ferns, mosses, mushrooms and some others.

SUCH is the system of Rivinus from the equality and number of the petals : a system, no less admired for its simplicity, than for the regularity and uniformity of its plan. Its facility in conducting to the knowledge of plants will best appear by an example. I am required to refer a plant of the common mallow to its proper class in Rivinus's method. The presence of both calix and petals excludes it at once from the eighteenth class, the characteristic of which is the absence of one or both. My next enquiry is, whether the plant in question pertains to the division of simple or compound flowers ? This, from my knowledge of the distinctive character, is immediately answered, and the plant referred at sight to the former branch of the method. By this step the three classes containing compound flowers are cut off, and my plant is adjudged to belong to one of the fourteen classes of the perfect, simple flowers which remain. I next examine the divisions of the flower, and finding them to be equal, not only in situation and figure, but also in size, I refer the plant to the

the division containing regular flowers, which occupy the first seven classes of the method. The number of petals next claims my attention: and here I must be particularly cautious not to confound plants of one class with those of another. For it frequently happens that flowers with only one petal are so deeply divided, that to a careless or superficial observer they appear composed of many petals. Rivinus's rule on this head is in general a good one. It is to reckon as many petals, as the flower resolves itself into, when fallen. The reader, however, is not to imagine, that in every case we are to wait for this criterion. It is only meant as a guide where the divisions of the flower are so deep that a doubt may well arise to what branch of the method the plant in question should be referred. In most cases, we can determine at sight whether the flower is composed of one or more petals. If the divisions only reach the middle of the flower, or occupy the upper spreading part, without extending to the tube or hollow part below, there is no doubt, the flower is manifestly of one petal, and arranges accordingly. If, on the other hand, the divisions reach the bottom of the flower, and do not adhere, even in the slightest degree, but appear each, by their similar conformation, to be totally distinct, and actually resolve themselves, on the falling of the flower, into as many separate parts as there were divisions when it remained upon the plant, the flower is manifestly composed of many petals, and must be referred to its corresponding division in the method. The former characters are generally sufficient to determine this: it is only, as we have said, in doubtful cases, that Rivinus's rule is to be applied. Neither indeed is the rule in question infallible: for though by it several plants, particularly wood-forrel, ledum, pimpernel and *trientalis*, are very properly adjudged to have but one petal, from the divisions being found to adhere, in falling off; yet should we commit a manifest impropriety by referring to a class with  
four



four petals the flowers of *vaccinium oxycoccus*, which, however, resolve themselves, on falling off the plant, into four distinct leaves. I am not even certain, whether in the example before us, which has furnished matter of controversy on this head, the rule just mentioned can determine with precision. Rivinus and Tournefort arrange plants of the mallow tribe with such as bear flowers of one petal. Linnæus, in his *Genera Plantarum*, has assigned to each five distinct petals. For my own part, I must confess that I lean to the opinion of the two former botanists, not only because I could produce several instances of flowers confessedly of one petal, in which the segments or divisions are equally deep with these of the mallow tribe; but also because the segments are rounded, not pointed at the base, where they likewise manifestly cohere. Since I am upon this subject, I cannot help remarking a very beautiful distinction between flowers of one and many petals, not known to Rivinus. It arises from the situation of the stamina, which, in flowers of more petals than one, are inserted into the receptacle or summit of the footstalk; in those of one, into some part of the petal. M. Vaillant, an ingenious French academician, was the first who made this observation, so far as it respects flowers of one petal: and Pontedera is said to have dissected two thousand different species with a view to establish its universality. By this rule, the flowers of *trientalis* and wood-forrel are determined to have only one petal, although the divisions, which are seven in the former, and five in the latter, cohere so slightly at the base, that, without such a mark of distinction as that I have mentioned, we should be at a loss whether to arrange the plants in question, at sight, with such as bear flowers of one or more petals. I do not, however, mean to insinuate that Pontedera's rule is a whit more infallible than that of Rivinus. On the contrary, I am sensible that, like every general rule, it admits of exceptions; and that it were equally rash to conclude every flower mono-

monopetalous which has the stamina attached to it, as to arrange among such as have more petals than one all flowers that, in detaching themselves from the plant, are resolved into two, three, four or more distinct pieces. In sea-pink, and the genus *melanthium*, the stamina are inserted into the petals, which are five in the former, six in the latter. *Lychnis*, *filene*, rose-campion, and some others of Linnæus's natural order, *caryophyllæi*, have the stamina alternately inserted into the claws of the petals, which are five in number. In these plants the number of stamina is ten; so that one half is attached to the receptacle or seat of the flower, and the other half to the petals. Again, there are instances of flowers with one petal, which have not the stamina attached to their substance. Of this kind are aloe, and *cissus*; as also azalea, arbutus, *ledum*, andromeda, heath, and the other flowers of Linnæus's natural order, *bicornes*, so termed from the *antheræ* or tops of the stamina exhibiting an appearance like two horns. To return to the illustration of Rivinus's method. The reasons mentioned above having determined me to regard the flowers of mallow as monopetalous, that is, composed of a single petal, its place among the simple regular flowers no longer remains a secret. These occupy, as we have said, the first seven classes, which stand distinguished from the number of petals. To the second, third, fourth, fifth, sixth and seventh my plant cannot be referred, because in these the characteristic is two or more petals. There remains only the first class, which consisting of regular flowers with one petal, must consequently include the plants of the mallow-tribe, whose flowers we have shewn to be perfect, simple, regular, and monopetalous.

It has been said that Rivinus's method, simple and uniform as it is, must, if strictly followed, be productive of an almost continual violence to nature, by disjoining things which were

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never meant to be separated, and confounding others which are in themselves totally distinct. I am admonished that not only different genera of the same natural class, but likewise different species of the same natural genus are exceedingly diversified with respect to the regularity and number of the petals; and that, consequently, characters derived from these circumstances must be of all others the most improper, from their manifest tendency to confound. This conclusion I deny, yet allow the truth of the affirmation from which it is deduced. In methods purely artificial, the principal object is to arrange plants in an easy simple manner. Regardless of their affinities, such methods are solicitous only to conduct with facility to their knowledge. Natural genera, no more than natural classes, must be preserved entire, in direct contradiction to the principles of the method. These are to be observed in all their rigour, or the great end of the arrangement is frustrated. In fact, natural genera exist not, but in a natural method. Every artificial method has its own proper genera, because the principle varies in each. To attempt therefore, to mould the genera of a system, professedly artificial, after those of a method not yet detected, and whose principles are totally different, is, in effect, not only to confound artificial methods with the natural, but to counteract the very end and intention of arrangement altogether. A genus is a subaltern division in every method; it subdivides the section or order, in like manner as the order subdivides the class. Certain characters flowing from the genius of the method serve to discriminate each division: the genus has its peculiar marks of distinction, by which, as by fixed laws, it is regulated and restrained. Can we then blame an author who, intent upon giving facility to his method, shall refuse to incorporate plants of the same supposed natural class and genus, when such junction cannot be effected without frustrating the arrangement, and destroying its essence?

Shall



Shall Rivinus be censured if, in a method founded upon the regularity and number of the petals, he has chosen to separate regular flowers from the irregular, and plants with one petal from such as have two or more, even although their agreement in the habit, and other characters, should determine some of those so separated to belong to the same natural class? Had he acted otherwise, he would have confounded his artificial character with the natural, and rendered his method of no avail. I am not to learn, that the excellence of the artificial character consists in its approximation to the natural; and that a method is undoubtedly rendered more valuable by the greater number of natural families which it collects. But still the end of an arrangement is to be kept in view; and if a multitude of natural classes cannot be collected by an artificial character, without frustrating that end, and rendering the method impracticable, I am clearly of opinion that such natural assemblages are to be abandoned without reserve, and that character adopted which, by its facility, bids fairest to be most extensively useful. Rivinus, however, is not only censured for employing a character which admits not of natural classes; he has also been reprehended for neglecting to retain such classes, although this he could not have done without infringing the fundamental laws of his method. Most of the liliaceous or bulbous-rooted plants have flowers composed of six regular petals: in a few, however, particularly hyacinth, crocus and narcissus, the divisions of the flower, which are six in number and equal, do not reach the bottom, and consequently form but one piece. I leave it to the reader to judge whether Rivinus has not very properly separated these different orders of the liliaceous plants, by arranging the latter with regular flowers of one petal; the former with such as have six distinct petals. Had he acted otherwise, I should have been the first to anathematize his method, as destitute of its only recommendation, facility. Again,



Rivinus is severely censured by Ray for removing viper's bugloss from the other rough-leaved plants, to which it is naturally allied. But here, as in the former instance, our author will be found perfectly in the right. Viper's bugloss has a very irregular flower of one petal; comfrey, borragé, hound's-tongue and the other rough-leaved plants are furnished with regular flowers, which, in shape, resemble either a bell, funnel or falver. Would a novice in Botany have reckoned himself obliged to Rivinus, if, solicitous to preserve unbroken the natural order, he had arranged viper's bugloss with its irregular flower among flowers confessedly regular? Rivinus was sensible of the impropriety of such a measure, which he knew could not be adopted but in direct opposition to his own principles: he has therefore very wisely avoided it, and transferred the genus in question to that division of the method containing irregular flowers of one petal, under which it naturally falls. His separation of tormentil from cinquefoil has met with a similar reprehension that is equally ill-founded. Tormentil has four equal petals, cinquefoil five. Would not Rivinus have merited censure, had he arranged these under one class? A person who turns over a dictionary expects to find the words arranged in an order strictly alphabetical: the least error in orthography, the slightest deviation from those laws by which the compilation is agreed to be regulated, render the nomenclature, in those particular instances, totally useless. It is just so with a botanical method. If it is agreed that all plants having the same number of regular petals shall be arranged under one class, in like manner as all words with the same initial letter occupy the same division of a dictionary; would it not be highly absurd, in direct opposition to such agreement, to place flowers of four petals in the same class with such as have five, or conjoin plants of one regular petal with such as have six? The learner would no more dream of such ridiculous junctions, than  
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he who peruses a dictionary expects to find the word BOTANY under the letter A. Other charges, of a similar nature with those already canvassed have been directed against our author by Ray, Blair, and the other lovers of affinities: but these I forbear mentioning, because the reader must be convinced, from the instances already quoted, that the improprieties imputed by these writers to Rivinus, are, in fact, the beauties and perfection of his method. An author who adopts a principle, is obliged to adhere to it with the most scrupulous exactness. The least deviation is an unpardonable error, because calculated to mislead. A convention is entered into by the author with the learner, and that convention he must religiously observe. The question is not, whether the principle be more or less excellent: it has been adopted, and must either be rigidly adhered to, or totally abandoned. If a writer is convinced of the insufficiency of his principle, let him adopt another, and new-mould his method accordingly: but let him never engraft one principle upon another; let the execution always correspond to the plan.

I NOW proceed to mention imperfections of a different kind that have been imputed to this method, and which, if indeed they have an existence, are chargeable, not upon the plan, but its execution. Some species of valerian have regular, some irregular flowers. Under what branch of Rivinus's method is the genus to be placed? if totally under the division of regular or irregular flowers, a manifest impropriety is committed, because the segments of the petal in some of the species are equal, in others, unequal: If partly under both, a violence is done to nature, and plants, to preserve the credit of an artificial character, are forcibly torn from the society of those to which they are most nearly allied. Such is the argument of the opponents of this method, which I trust to answer to the satisfaction of the reader. It proceeds.



ceeds upon an implied supposition that genera are as fixed and invariable as species, than which nothing can be more false or hypothetical. In every artificial method the genera are different, because the genus, in such methods, is as arbitrary a division as either the class or order. The principle of every artificial method is different; its classes are different; the genera therefore, which are only subaltern divisions of the classes, must be different also. Is it not evident, that the same principle which new-models the class or primary division, must operate in fashioning the genus or subordinate one? If the genera were indeed fixed, as is pretended, artificial methods could be of no utility whatever: as all the species of such genera would very rarely be found to arrange themselves under their proper class and order. Most of the intricacies in the sexual system proceed from this source, as will afterwards be fully shewn. This being premised, I am ready to answer the question that was proposed above. To me, indeed, the alternative never appeared difficult, because I am clearly of opinion that the principles of a method are to be observed in all their rigour, notwithstanding any seeming inconveniencies with which so strict an adherence may be attended. In a method founded upon the equality of the petals, all regular flowers naturally arrange themselves under one division, all irregular flowers under another. It is in vain that I am told of natural genera being split by such a mode of arrangement; I acknowledge no natural genera in an artificial method: I disavow every genus that is independent of its class and order, and claims to be ascertained without their assistance. As a subaltern division, not of the class only, but also of the order, a genus must possess the distinguishing characters of both. For if the class character is wanting, we mistake the class: if that of the order, we mistake the order: and it is evident, that if the plant is referred either to a wrong class or order, it can never be detected: the genus must



must always remain unknown. Perhaps few of the plants which now arrange as species of valerian were known to Rivinus; if they had, I make no doubt that he would have formed them into several genera, had the principles of his method required it. I shall only add, that if, in arranging the species which he confessedly knew he has, in any respect, violated those principles, the fault ought solely to be imputed to the author, not to his plan. Again, the European species of *Geranium* being furnished with a regular flower, the African with an irregular, Rivinus has very properly formed them into two genera, by the names of *Gruinalis*, that is, crane's bill, and *Geranium*, which he has placed, one in the division of regular, the other of irregular flowers. The author cannot be so well defended for placing all the umbelliferous plants in a class containing irregular flowers; many of them, and those known to Rivinus, particularly lovage, hog's fennel, fium, parsley, and herb-gerard, have five petals that are perfectly equal. These, undoubtedly, should have been transferred to the division containing regular flowers, because they do not possess the character of the division in which they are placed. The lip-flowers occupy part of that class in Rivinus's method which is destined for containing plants with one irregular petal: yet may it be doubted whether mint, iron-wort and water horehound do not more properly fall under the division containing regular flowers; as, in the plants in question, the upper lip is scarce to be distinguished from the lower, and the flower, at first sight, appears to be divided into four equal parts. There is a manifest impropriety too in arranging with the irregular flowers of four petals such pea-bloom flowers as have undoubtedly five. Of this kind are liquorice and broom, in which the keel or innermost part of the flower forms two distinct petals. Other papilionaceous flowers, not known to Rivinus, are found to consist of five irregular petals. Such are *securidaca*, coral tree,  
*borbonia*,



*borbonia*, furze, and *psoralea*; in the first of which the standard, in the rest the keel, is divided into two parts that are totally distinct. Some species of trefoil have an irregular papilionaceous flower of one petal, the standard, wings and keel being conjoined. It would therefore be highly improper to place these in Rivinus's method along with the other trefoils, which are furnished with four irregular petals. They ought, in conformity to the principles of the method, to form a separate genus, and be transferred to the class containing irregular flowers of one petal. I do not much approve of fumatory and balsam being placed with the papilionaceous flowers. Christian Knaut has judged better in transferring the former to the class of irregular flowers with two petals: and as to the latter, it has generally five irregular petals, and therefore should be removed to the class which immediately succeeds. Some species of balsam, which want the two intermediate petals, are to be placed without reserve in the class containing irregular flowers with three petals. With respect to the genus *statice*, which has been urged against our author, because a particular species, the *statice monopetala* of Linnaeus, bears flowers of one petal, whilst the rest have five equal petals, it is certain, that no species of *statice* are mentioned either by Rivinus or Heucher; and, it is highly probable, if they had, that the species alluded to would have been removed to that division of the method, whose classical character it possesses. In arranging the compound flowers, Rivinus has been guilty of a real impropriety. We have seen that Morison, Ray and Herman did not scruple to rank with the compound flowers, scabious, teazel, and a few other plants, which, though they do not absolutely possess all the distinguishing characters of that tribe, yet are so approximated to it by their general appearance, that no great violence is done either to nature, or the principles of the method by combining them. The simple flowers which Rivinus has  
annexed

annexed to this tribe have not even the plea of affinity to offer. In fact, who would think of placing water-lilly, fennel-flower, and hellebore in the same class with the compound flowers? They possess no natural relations; nor do I believe that there exists an artificial character which could approximate them. Rivinus's principle of combination is no less strange than the combination itself. Compound flowers, properly so called, he considers with Jungius as flowers that are naturally full; the simple flowers just mentioned, as flowers naturally double, and consequently connected with the former, in the same manner as flowers that are rendered double by luxuriance of nourishment have a manifest affinity to such as, from the different agency of the same cause, are rendered full. Our author's application of this very extraordinary principle will be best understood by an example. Yellow water-lilly has a flower-cup of five distinct pieces, within which are placed a number of petals in more than a single row or series. The flower-cup Rivinus reckons the outermost row of petals; and although its five leaves are dissimilar to the internal petals, yet is each cover regular, considered in itself, because its parts are similar and equal. For these reasons Rivinus has arranged the water-lilly with those compound flowers, all whose florets are regular. It is described to have a regular flower of five petals in the circumference or ray, and one of many petals, likewise regular, in the center or disk. Again, fennel-flower has five flat regular petals, within which are placed eight singular appearances, termed by Linnæus, *Nectaria*, each furnished with two lips. Rivinus arranges this plant with the radiated flowers of Tournefort, and assigns for his reason, that it is composed of a regular flower of five petals in the circumference, and of several irregular flowers of one petal in the center: the former corresponding to the real petals of the flower, the latter to the *nectaria*.



IN the uniformity of its orders or secondary divisions, which are ninety-one in number, and acknowledge the fruit for their principle, the method before us equals, perhaps excels, all that went before or succeeded it. Only three classes of his method were published by Rivinus himself. These are the eleventh, fourteenth and fifteenth, which contain irregular flowers of one, four and five petals, and were given to the world at different times, illustrated with very splendid figures. The method was compleated and published entire by Heucher in a work entitled *Hortus Wittenbergensis*, printed in quarto at Wittenberg in 1711.

SEVERAL German authors have followed Rivinus's method, either wholly or in part, without offering any considerable amendment. The principal of these are, Koenig, in a work on vegetables, published at Basil in 1696; Welsch, in his *Basis Botanica*, printed at Leipzig in octavo, in 1697; Gemeinhart, in a catalogue of plants published in 1725; Kramer, in a work entitled *Tentamen Botanicum*, published at Dresden in 1728, and afterwards reprinted with additions at Vienna in 1744; and Hecker, in a dissertation on Botany published at Hal in Saxony in 1734. To these may be added Hebenstreit, an ingenious botanist, who, in a treatise on plants, published at Leipzig in 1731, just before his famous African expedition, established generical characters, which had hitherto been wanting in Rivinus's method.

THE writers who have affected to improve upon the method under review are Bernard Ruppian, Christopher Ludwig and Christian Knaut, likewise Germans. Of these in order.

RUPPIUS, in his *Flora Jenensis*, published at Frankfort in 1718, has arranged the twelve hundred plants there described by a method,

a method, partly Rivinus's, and partly his own. It consists of seventeen classes, and sets out with the same divisions and subdivisions as that of his author, with this difference, however, that, whereas in Rivinus, all perfect flowers are divided into simple and compound; in Ruppianus, the division of regular and irregular flowers precedes that just mentioned, and simple and compound flowers are made subdivisions of the regular flowers only. If Ruppianus meant this as an improvement, he has certainly mistaken his aim. By restricting the compound flowers to that division of the method which includes regular flowers and none other, he has, in fact, asserted that all compound flowers are regular; an assertion in which he stands contradicted by the merest beginner; nay, even by himself: for, in the distribution of that tribe of plants, Ruppianus's orders exactly correspond to Rivinus's classes, and consist of such compound flowers whose florets are either all regular, all irregular, or composed of both. The fact is, that Rivinus led his imitator into the error complained of, by improperly interjecting the compound flowers betwixt the regular and irregular simple flowers. In Rivinus's method, the imperfect flowers are contained in one class; in that of Ruppianus, they are parcelled out into three, one of which contains the grasses, another, the cone-bearing plants, such whose flowers grow in catkins, and a few others; and a third, the ferns, mosses and mushrooms, which want the flower altogether. These classes, the reader will remember, correspond to most of the sections in Rivinus's single class. Ruppianus has judged wrong in excluding from his method the class containing irregular flowers with many petals; because, although no plants were known to that author, no more than to Rivinus, that could arrange themselves under such class, yet plants of that description might be afterwards discovered, and a method, to be universal, ought to accommodate itself no less to future discoveries than to those



already made. In short, the only real improvement which Rupp-  
pius has made upon Rivinus's method is in disincumbering the  
compound flowers of scabious, teasel, eryngo, passion-flower,  
hellebore, fennel-flower, water-lilly and pine-apple, which Ri-  
vinus had very improperly thrust into that tribe.

CHRISTOPHER Ludwig's method, which was published in  
1737, and consists of twenty classes, differs but little from that  
of Rivinus. The author accompanied Hebenstreit on his expe-  
dition into Africa, and seems to have made plants his favourite  
study. I cannot, however, congratulate the learned reader on  
the improvements which Ludwig has pretended to make on Ri-  
vinus's plan. To me they appear not only useless but detrimen-  
tal. Part of Rivinus's class, containing the imperfect flowers, is  
transferred to the division of perfect or compleat flowers, and  
for that purpose these last are subdivided, from the presence or  
absence of the petals : the plants so transferred being described to  
be such as want the petals, but are furnished with the flower-  
cup. This, as the reader will remember, is Ray's distinction  
revived, the inconveniencies of which need not be here repeated.  
Ludwig follows Rupp-  
pius in restricting the compound flowers to  
that division of the method which contains plants with regular  
flowers, and in excluding Rivinus's class of irregular flowers with  
many petals. Like Rupp-  
pius, too, he distributes the imperfect  
flowers among three classes, which, however, do not exactly  
correspond in both methods. The palms, grasses and some other  
plants occupy the first ; the cone-bearing plants, and those whose  
flowers grow in catkins, the second ; the ferns, mosses, mush-  
rooms, and submarine plants, the third. In fine, Ludwig's me-  
thod is only that of Rivinus rendered more universal ; the author  
having enriched it with a multitude of genera, collected from the  
works of Tournefort, Ray, Boerhaave, Dillenius, and other  
eminent

eminent botanists, whose generical characters he has likewise adopted. His plan of arrangement has been followed by two succeeding writers: M. Wedel, in a botanical Essay, published in 1747; and three years after by M. Boehmer, in his Catalogue of the Plants which grow in the neighbourhood of Leipzig.

CHRISTIAN Knaut, although prior to both the writers just named, I have chosen to mention last, because the plan of arrangement which he proposed, is more properly his own, and departs in a much greater degree from the principles of Rivinus than that of either Ruppius or Ludwig. The regularity and number of the petals furnished, as we have seen, the classical distinctions in Rivinus's method; in that of Knaut, number takes place of regularity; so that it is very properly termed by Linnæus, the system of Rivinus inverted. The method in question, which consists of seventeen classes, and was published at Leipzig in 1716, sets out with a division into flowers which have one petal, and such as have more than one. Flowers with one petal occupy the first five classes, and are subdivided into simple and aggregate. These last, the compound flowers of Rivinus, constitute the third, fourth and fifth classes, which stand distinguished as in the original author. Simple flowers with one petal arrange themselves in the first and second classes, and are subdivided from the equality and inequality of the flower. The same character predominates in the several subdivisions of the second great branch of the method, that, to wit, containing flowers with more than one petal. These subdivisions are six in number, and consist each of two classes, which, like the simple flowers with one petal, stand distinguished by the regularity or irregularity of the flowers. The first phalanx of the grand division alluded to contains flowers with two petals, and those  
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either regular or irregular ; the second, three ; the third, four ; the fourth, five ; the fifth, six ; the sixth, many, or an indefinite number.

SUCH is the skeleton of Christian Knaut's method, which, as the reader will observe, is incomplete, because the plants with imperfect flowers, which form the eighteenth class of Rivinus, find no place in the system of our author. It was Knaut's intention to remove this defect in a future edition of his work ; but as far as I can learn, he never completed his purpose. The sections or secondary divisions are an hundred and twenty-one in number, and depend upon the internal divisions of the fruit. Upon this subject, the opinions of Knaut are somewhat singular. Every kind of fruit, whether pulpy or membranaceous, is denominated by our author a Capsule. Neither is this term restricted to fruits properly so called : it is extended also to those termed by botanists, *naked seeds*, the existence of which Knaut absolutely denies. I formerly demonstrated that this opinion proceeds upon mistaken notions of the analogy subsisting between plants and animals. Difficult as it certainly is to establish a criterion which, in every case, shall, with accuracy, discriminate naked from covered seeds ; it were highly absurd to dispute the reality of the distinction. I appeal to the reader whether he entertains any doubt that the umbelliferous plants, the compound and lip-flowers are furnished with true naked seeds ; or, if he had rather adhere to Christian Knaut's opinion, and denominate the fruits in question, capsules with an undivided cavity, and a single seed. Since I am upon this subject, it will not be improper to explain a few terms which occur in our author's method, and which, if understood, will greatly facilitate the knowledge of his secondary characters. It has been already mentioned, that every kind of fruit, whether properly or improperly so called, is termed by  
Knaut

Knaut capsular. Capsules, with respect to their consistence or substance, are of two sorts, pulpy or succulent and membranaceous. The former correspond to the fruits of the apple, berry and cherry kind; the latter to the capsules properly so called, and naked seeds of other botanists. Again, with respect to their cells or internal divisions, Capsules are either simple or compound. Simple Capsules have an undivided cavity or a single cell; compound capsules are internally divided into two or more cells. With other botanists, the umbelliferous plants bear two, the lip flowers four, naked seeds; according to Knaut, the former produce two simple capsules, the latter, four. Ranunculus, adonis, anemony, herb-bennet, and some other plants have their flowers succeeded by a number of naked seeds collected into an aggregate or head. Each of these seeds passes with Knaut for a simple Capsule; so that the whole is an aggregate of several capsules with an undivided cavity or single cell. In numbering the cells or internal divisions of the pulpy fruits, our author has adopted a very singular mode of calculation. Some fruits of the apple kind inclose a capsule that is divided into five membranaceous cells. Might we not then very reasonably expect to find such fruits arranged with compound capsules of five cells? In vain, however, would be our most unwearied search in that quarter. The author whimsically enough combines in their arrangement the idea both of a simple and compound capsule. The pulpy part is undivided, in other words, it is a simple capsule furnished with one cell; the compound capsule inclosed contains five cells, which added to that of the pulp make the number six; and with compound capsules of six cells are the fruits in question made to arrange. It is by the same paradoxical reasoning, that the fruit of dogwood which is of the cherry kind, and contains a stone with two cells or cavities, is placed by Knaut among compound capsules with  
three



three cells; the pulp passing for one division, the cavities of the stone or nut for the remaining two.

SINGULAR as is this mode of calculation, it is not the only paradox which our author has been accused of maintaining. The essence of the flower is made by Ray, Tournefort, Rivinus and most botanists to consist in the stamina and style. This position Knaut absolutely denies, and has established for a principle, that the flower is essentially constituted by the petals only. The flower-cup, stamina and style are of little significance with Knaut; their presence does not constitute a flower, if the petals are wanting; neither is their absence sufficient to destroy its existence, if the petals are present. From this proposition two corollaries are evidently deducible. The one, that a flower without petals is a solecism in Botany; the other, that the regularity and irregularity of the flower can never depend on the stamina and style, which are only occasionally present, and in no wise essential to its existence. It were unnecessary to observe on these doctrines; their fallacy must be obvious to every reader.

I CLOSE my review of Knaut's tenets and method of arrangement with the examination of an heretical aphorism laid down by that author respecting his distribution of the genera. To be qualified for pronouncing of its merits, we must have accurate and precise ideas upon the subject; and these can in no way so certainly be obtained, as by an enquiry into the nature of that particular member of a method denominated a genus. In every artificial plan of arrangement, the classical character is arbitrary, and depends upon a single circumstance. The orders or secondary divisions are subdivisions of the class; each order therefore, besides its own proper character, possesses the common character of the class, of which it is a subdivision. As orders subdivide the  
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the class, genera subdivide the order: each genus, therefore, whilst it possesses the common characters of the class and order, must stand distinguished from all of the same order, by means of some character that is proper and peculiar to itself. The subdivisions of a genus are termed species, each of which must consequently agree in the common characters of the class, order and genus, and be distinguished from its congeners by the possession of a character that is properly its own. Such is the real state of the subordination that ought to be observed betwixt the several parts or members of an artificial method. As striking characters, however, cannot be found for discriminating every genus, it has been thought necessary, in default of such essential marks, to call in the assistance of various parts of the plant, that the characters thence derived might atone, by their number, for the want of notoriety. The parts of fructification seemed, of all others, the most proper for this purpose. These had, ever since the time of Gesner, furnished the sole classical distinctions; and it was that author who first suggested their utility in discriminating the genera. In every orthodox method, the common generical characters must be founded on the parts of fructification, because the genera are only subdivisions of the class and order which acknowledge those parts for their principle of distribution. For this reason, it appeared to Gesner highly proper that the discriminating character of genera, no less than that of classes and orders, should be derived from the parts of the flower and fruit. It is in very few cases, however, that a single distinctive generical character will suffice. What then is the most eligible way of discriminating the genera, where conspicuous and essential characters are wanting? To call in the aid of a multiplicity of characters, and substitute many in the place of one. It has furnished matter of controversy to botanists, whether such



characters should be solely derived from the parts of fructification, from a combination of these and the other parts of the plant, or occasionally only from the latter. Tournefort, the first who realized Gesner's idea respecting the distribution of the genera, never fails to have recourse to the other parts when those of the flower and fruit prove insufficient. But it is only in cases where their assistance cannot be dispensed with, that Tournefort has thought proper to employ the parts in question. His primary genera, or genera of the first order, agree only in the parts of fructification; his subaltern genera, or those of the second order, call in the other parts of the plant as auxiliaries. Linnæus has adopted the principle of Gesner in all its rigour; and lays it down as an aphorism in no case to be departed from, that generical characters are to be derived from all the parts of fructification, and from none other. The habit or general appearance of plants, the various modes of flowering, the structure of the root, stem and other parts unconnected with fructification, are employed in furnishing generical distinctions by a third set of writers, in combination with the parts of the flower and fruit. With botanists of this class, Christian Knaut is properly to be ranked, although the aphorism to be examined is, perhaps, peculiar to himself. The description of a genus, according to Linnæus, is an enumeration of all the parts and modifications of the flower and fruit of the plants which compose it. These parts too, ought, in strict propriety, to be exactly the same in all the different species: as a genus is constituted by the agreements of a number of species in the parts of fructification. But two species are very rarely to be found that agree in all the organs of the flower and fruit, and their several modifications. It is with some latitude, therefore, that we are to understand the term genus; for if, to constitute such an assemblage, it were necessary that the parts of the flower and fruit of the several species be in every respect

respect similar, the very end of the division is frustrated, and genera are resolved into mere species. This position, however, absurd as it must appear, has had its abettors, and is, in fact, the very aphorism which I have been preparing the reader to confute. It is a maxim with Knaut, that the minutest difference in any of the parts of fructification in two different species is sufficient to justify a separation of such species under different genera; nay, that it is absolutely unsystematical to place plants with four petals in the same genus with such as have five, or fruits of three cells with such as have four. It has just been hinted, that a rigorous observance of this rule would occasion an unnecessary multiplication of genera, or rather indeed annihilate genera altogether, by confounding them with species, which are properly their component or constituent parts. But with whatever zeal I am inclined to oppose a dogma so big with absurdity, and which, if strictly followed, must sap the very foundations of the science, I would by no means wish to have it inculcated that, in the distribution of genera, too great latitude cannot be used. The enormous weight of genera is, in fact, no less prejudicial to Botany on the one hand, than the unnecessary multiplication of their number is on the other. To avoid either extreme ought to be the care of every systematic writer, who cannot be too often reminded that the science is in equal danger from both. Let it be remembered likewise that genera, to be perfect, must accommodate themselves to the principles of the method under which they arrange. This rule must be inviolably observed; it admits of no exception whatever; the slightest deviation is attended with unavoidable confusion. If genera through all their species do not invariably possess the common characters of the class and order of which they are subdivisions, by what rule shall they be investigated? In a method founded upon the number of petals, we should never dream of looking for



genera with flowers of five petals in the same class with such as have six; neither, for the same reason, should we expect to find a different number of petals in the different species of the same genus. Again, if the orders or secondary divisions derive their characteristical distinctions from the parts of the fruit, it is obvious, that the fruit of all the species of each genus must agree in that particular mark which characterises the order. Fruits of four cells are very improperly placed in the same order with such as have five; and that whether the whole genus, or a particular species only, is deficient in the character of its respective order. If the former, the genus must be totally transferred to an order whose character it possesses; if the latter, it is resolved into two distinct genera which arrange themselves under separate orders. Upon the whole, though I entirely disapprove of Knaut's maxim, and can discern every bad consequence with which its most rigorous observance would be attended, I cannot help thinking it entitled to some share of indulgence, when it is considered that the author has been most probably betrayed into this error by a laudable desire of accommodating the genera to the principles of his method. This opinion I am the rather inclined to adopt, as, in proposing the aphorism in question, our author has particularized the circumstance of number, which furnishes both his classical and secondary characters; the former being derived from the number of petals, the latter from the number of cells or internal divisions of the fruit.

WE are now arrived at the most important æra in the history of Botany. Here therefore the reader will not be displeased to stop with me for a moment, whilst I briefly recapitulate the subject of the foregoing sheets. It was the professed intention of this prefatory VIEW to trace Botanical knowledge through the various stages of its progress, to distinguish artificial methods from

from the natural, and point out the respective excellencies of each, to establish orthodox doctrines respecting the distribution of the genera, to illustrate, analyse and compare the various plans that have been imagined for arranging vegetables; in fine, to render Botany a science of easy attainment, by removing the obstacles that have retarded its progress. In the prosecution of this plan, I have hitherto endeavoured to express myself with as much precision and perspicuity as the nature of the science and our language would admit. The artificial methods that have been analysed are those of Cæsalpinus, Morison, Ray, Christopher Knaut, Herman, Boerhaave, Rivinus, Ruppius, Ludwig and Christian Knaut: the four last from the number of petals, the rest from the substance, number and figure of the fruit. Partial attachments to particular systems are totally unbecoming the gravity of a philosophical discussion; I have therefore carefully avoided lavishing praise where I could not impress conviction of its being properly bestowed. It is for the same reason that, whilst I have studied to do justice to the merits of each systematic writer, who has hitherto passed under review, I have held forth none as infallible or void of imperfection. The man who, in matters of science, wilfully conceals the errors of another adopts them as his own. Upon this principle, I have ventured in a few controverted points to differ from some distinguished names in Botany. For the fate of such criticisms, however, I am in no wise solicitous. By the blindly partial they will perhaps be condemned without a hearing; by the man of candour and ingenuity they can scarce fail of being treated with respect, in honour of the principle which gave them existence. I, for my own part, glory in asserting the right of free enquiry; I disclaim a slavish attachment to any sect or system, however eminent; I acknowledge no pope in science: the human mind is free and unconstrained; it is fit that the spirit of enquiry should be free also.

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I CONCLUDE the present section with observing that since the time of Rivinus, only two leading methods have been offered to the world. These are Tournefort's from the figure of the petals, and the celebrated sexual system of Linnæus from the number, situation, union and proportion of the stamina. A particular illustration of each of these methods, with a view of their comparative merits, will make the subject of the two following sections.

SECTION











